Missouri White-Tailed Deer Management Review

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DEER PROGRAM HISTORY

Introduction

The white-tailed deer (*Odocoileus virginianus*) is arguably the most important game animal in North America and certainly one of Missouri's most valuable natural resources. Deer are both socially and economically important to the citizens of Missouri, providing ample opportunity for enjoyment as well as a variety of management challenges. Moreover, white-tailed deer hunting has become an important part of Missouri's wildlife conservation heritage and modern day traditions.

The Missouri Department of Conservation (MDC) uses a scientific approach for consideration of the biological and social issues associated with meeting its responsibility of managing the state's deer population, and the overall deer management program has evolved significantly throughout the Department's history. We have learned a great deal about white-tailed deer biology and population dynamics, hunting opportunities have expanded, human dimensions play a large role in our management decisions, and many challenges to traditional management have presented themselves, such as populations of urban deer and the potential for a decline in deer hunter numbers. ***Today our deer management goal emphasizes maintaining deer numbers at levels that are consistent with the land to support deer, providing deer hunters and viewers with acceptable levels of opportunity, and minimizing conflicts between humans and deer.*** As a result, we must consider an ever changing combination of economic, political, philosophical, and biological factors, while maintaining clear management objectives and adhering to sound scientific principles.

This document is to serve as a review of relevant information and related issues as they pertain to the management of deer in Missouri, and will be used as supporting information for the development of a Missouri Deer Management Strategic Plan.

Deer as a Public Trust Resource

All wildlife, including white-tailed deer are considered public trust resources, not belonging to any one individual but to all citizens of Missouri. The Department has been entrusted to manage these resources for the citizens of the state by virtue of the constitutional mandate. Economic and social forces sometimes blur the lines between public and private resources, and deer have not been immune from these debates. Therefore, without clear deer management goals, active engagement of the public, and a sound scientific basis for deer management policy there is a risk of privatization of wildlife (i.e., deer) which in turn jeopardizes our hunting heritage and ability to ensure hunting opportunities for all citizens. It is critical that the Department maintains public approval and support for deer management activities to ensure sound science-based management into the future.

Historical Account of Missouri Deer Management

Pre-1930's– Decline of the Missouri Deer Herd

Pre-settlement, white-tailed deer were found throughout the state with the highest densities occurring in northern Missouri. Like so many wildlife species in the latter half of the 19th century, deer numbers declined as European settlers colonized Missouri. The decline occurred at a time when humans were impacting the landscape at a scale never before experienced. Throughout much of Missouri, forests were cut, most accessible land was grazed or farmed, and humans were scattered on small parcels of the rural landscape. This decrease in deer resulted partly from the human-induced environmental changes; additionally, overexploitation as a result of local consumption and market hunting played a very important role.

Deer population declines were becoming evident by 1870 and local statutes were instituted to try and stem the decline. The first statewide legislation aimed at protecting the deer population did not occur until 1874 when a 9-month closed season on deer was imposed. However, deer were still being market hunted. With no provisions for enforcement of the laws early legislation was largely ineffective. The first effective law was implemented in 1905 (Walmsley Law), and reduced the deer season to 2 months; does and fawns were protected year round. The Walmsley Law also provided for the first paid game wardens. However, this law suffered setbacks and was repealed in 1907. Meanwhile, deer numbers continued to decline to a low of around 400 deer in 1925 when the deer season was completely closed. Wildlife refuges were acquired and for the first time, deer from other states were brought in for restocking. The state legislature reopened the deer season in 1931 for bucks only which remained in effect until 1938 when the newly formed Conservation Commission closed the season. Although there had been some small increases in deer numbers since the low in 1925, the creation of the Department of Conservation and the Conservation Commission initiated the first significant and successful efforts to restore many wildlife species, including deer.

1930's-1980's – Restoration of the Missouri Deer Herd

The white-tailed deer is highly adaptable to human activities and in spite of human impacts on Missouri landscape, deer tolerated or even took advantage of the changes and flourished. However, population recovery would not have occurred without a change in public attitudes toward wildlife. Early efforts to stem the decline in deer populations through regulation generally failed because of the lack of public support. In the early twentieth century, attitudes toward wildlife shifted from a utilitarian to a more conservation oriented emphasis; citizens recognized their impacts on wildlife and began supporting efforts to protect and restore many wildlife species. As a result, the stage was set for recovery of many species when the Missouri Department of Conservation was formed and modern day conservation began.

In 1938, the first Commission put into place several programs aimed at protecting and restoring deer, and other wildlife species in Missouri. Enhanced wildlife law enforcement, expanded refuge program, control of unwarranted forest fire and over-grazing, progressive timber and wildlife habitat management, public conservation education programs, and an aggressive deer trapping and relocation effort were all important steps in restoring the state's deer population. These efforts stimulated rapid growth of the deer population and by 1944 there were around 15,000 deer in Missouri and the Commission established the first modern day firearms hunting season (Table 1). Archery hunting opportunities also increased as deer numbers increased (Table 2). The first archery season was a 3-day hunt held in one county in 1946 but the first deer was not taken until 1950. The first statewide archery season was held in 1963.

Early deer biologists were breaking new ground as the profession of wildlife management was beginning to emerge. As a result, biologist frequently made decisions in the absence of information on which to base hunting seasons. State agencies varied greatly in how they managed deer hunting seasons and harvests, and the amount of resources dedicated to research, habitat management, and enforcement of regulations. However, in spite of the many differences in management strategies employed by various states, recovery occurred throughout the range of white-tailed deer; albeit at different rates. The key element of successful recovery in all cases was protection from over exploitation. In an effort to avoid overexploitation, nearly every state imposed restrictive regulations on the length of the deer season regulations and greatly limited doe harvest.

Deer management at the time was relatively simple because the objective was to grow deer populations and this could be accomplished primarily by protecting does. In Missouri, early deer biologists realized the importance of population management and the role of doe harvest on population growth. In a proactive response to rapidly growing deer population, the harvest of antlerless deer was initiated in 1951. The early initiation of antlerless harvest proved beneficial as population goals evolved from rapid deer population growth to stabilization. Hunters in states with long histories of restrictive doe harvest were much more reluctant to harvest does resulting in many deer populations exceeding their biological carrying capacity. Missouri's history of having hunters accustomed to shooting does made population management much easier as deer numbers increased. As a result of a growing deer population the firearms deer season and hunting regulations were continually evolving, particularly concerning the liberalization of doe harvest (Figure 1). Ultimately, a quota system was implemented in 1974 to allocate opportunity to take antlerless deer. A person could apply for an any-deer permit that allowed the hunter to take any sex or age of deer. Random drawings determined who got these permits. If not drawn for an any-deer permit hunters could obtain a permit that allowed them to take an antlered deer.

In addition to an evolving firearms season, the rapidly expanding deer population afforded the opportunity to liberalize the length and timing of the archery season by expanding from Oct. 1-31 to Oct. 1-Nov. 30 in 1957 and Oct. 1-Dec. 15 in 1958. Only a few minor changes to the archery season were made until 1973 when a split season (Oct. 1-Dec. 31, excluding the November portion of the firearms season) was implemented. Archery bag limits also have increased over time. One antlered deer could be taken from 1946-1950, one deer of either sex in select counties from 1951-1962, and one deer of either sex statewide from 1963-1987.

1980's-Present – Stabilization of the Missouri Deer Herd

By the late 1980's deer populations across the state had been restored and were growing rapidly. This era of rapid population growth was met with increasing liberalization of regulations and expanding hunting opportunities. Prior to 1987 a hunter could take only one deer during the firearms season. In 1987 hunters in some areas where stabilization of deer population growth was desirable could take an additional antlerless deer on a bonus permit. A muzzleloader season was implemented in 1988, an antlerless portion of the firearms season was established in 1996, and the quota system was eliminated in 2003; all permits could be bought over-the-counter. In 2004 we started using counties as management units and a person could use any number of antlerless permits in many counties in northern, central and western Missouri (Figure 14). Additionally, an antler point restriction (APR) regulation intended to shift harvest pressure from bucks to does was implemented in 2004 in 29 counties and was expanded to 65 counties in 2008. All of these changes were intended to address growing deer populations and have been

effective in most rural settings with deer populations in many counties stabilizing or declining after 2007. Since then reductions in doe harvest has been desirable in some counties; elimination of unlimited antlerless permits has been implemented in some counties and will be considered for others.

Additional archery season liberalizations included extending the length of the archery season through January 15 in 1995 and expanding again in 2004 when the season opened on September 15. Additionally, 2 deer of either sex could be taken (1 before and one after the firearms season) from 1988-1994, and 2 deer of either sex could be taken (2 could be taken except that only one buck could be taken before the firearms season) from 1995 to date. Urban archery permits (up to five per hunter) were first issued in 1996 but could be used only in the St. Louis and Kansas City areas. The Columbia area was included in 1997. The St. Louis and Kansas City areas in which these permits could be used were expanded in 1999. The name of these antlerless permits was changed to archery-only antlerless permits in 1999, and the areas in which they could be used gradually expanded to include most Missouri counties by 2004. Up to five of these permits could be purchased until 2003 when unlimited numbers could be obtained.

Traditional deer management of the past focused on increasing deer numbers at a large geographic scale which was relatively simple to accomplish through limited harvest quotas. Today we spend more time managing for stable or reduced deer populations rather than growing populations. Now that populations have been established statewide we are more focused on managing local or county level conditions that are driven by differences in environmental, social, and political factors. Therefore, managing for stable populations and reaching the delicate balance of stabilizing deer numbers at socially acceptable levels is more localized and difficult than management efforts in the past. As a result of the increasing complexity of deer management issues we need more detailed information about deer demographics and stakeholder opinions of deer populations to ensure successful science based management.

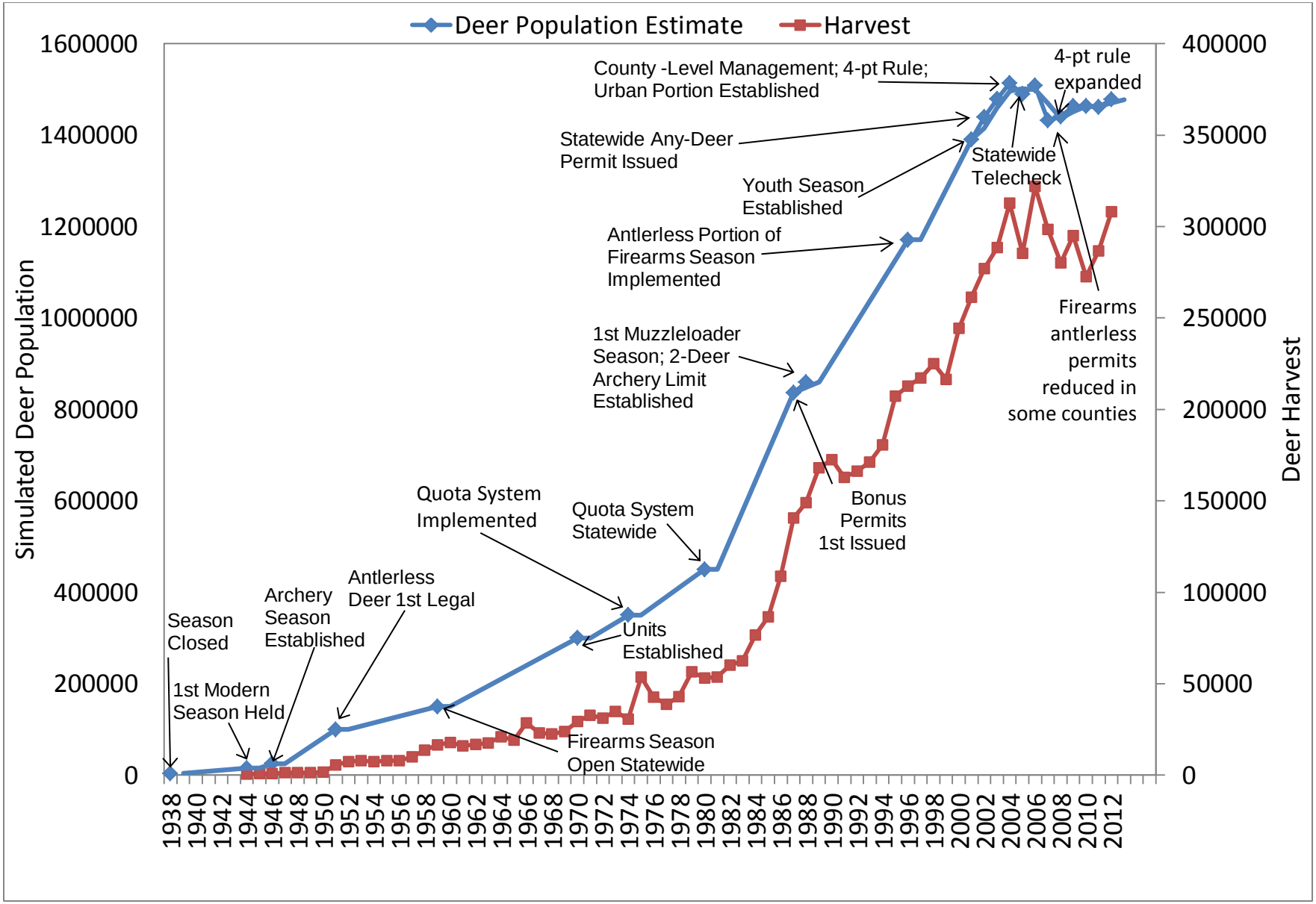


Figure 1. Historical white-tailed deer abundance, regulations changes, and harvest totals in Missouri.

Table1. Firearms deer hunting season and harvest summary from 1944-2012.

Year	Season Dates	Bucks-Only		Any-Deer		Permits Sold	Harvest
		Days	# of Counties	Days	# of Counties		
1944	Nov. 3-4	2	20	--	--	7,557	583
1945	Nov. 1-3	3	21	--	--	11,196	882
1946	Nov. 1-2	2	21	--	--	15,079	743
1947	Nov. 6-8	3	25	--	--	17,747	1,387
1948	Dec. 6-10	4	25	--	--	20,708	1,432
1949	Dec. 6-10	4	25	--	--	19,103	1,353
1950	Nov.27-Dec.2	6	26	--	--	18,749	1,623
1951	Nov. 5-7	3	17	3	15	30,237	5,519
1952	Dec. 4-6	3	19	3	23	37,791	7,466
1953	Nov. 5-7	3	6	4	41	45,015	7,864
1954	Nov. 3-6	4	12	5	44	45,889	7,648
1955	Nov. 1-5	5	8	5	53	48,524	7,988
1956	Oct.30-Nov.3	5	9	5	54	49,106	7,864
1957	Nov. 5-9	5	13	6	50	49,907	9,986
1958	Nov. 17-22	6	13	6	50	59,392	13,610
1959	Nov. 16-21	6	60	7	54	68,282	16,306
1960	Nov. 15-21	7	61	7	53	85,931	17,418
1961	Nov. 15-21	7	60	7	54	90,346	15,967
1962	Nov. 15-21	7	22	7	92	102,785	16,516
1963	Nov. 15-21	7	59	7	55	105,501	17,304
1964	Nov. 13-19	7	20	7	94	121,713	20,619
1965	Nov. 15-21	7	60	7	54	110,093	18,785
1966	Nov. 12-18	7	29	5	85	130,642	27,965
1967	Nov. 18-22 Dec.1-3	5 3	51 Statewide	5	63	150,105	22,802
1968	Nov. 16-19 Nov. 30-Dec.7	4 8	32 Statewide	4 --	82 --	159,262	22,090
1969	Nov. 15-24	10	67	4	47	144,436	23,265
1970 [1]	Nov. 14-23	10	Unit System			164,074	28,400
1971	Nov. 13-21	9	Unit System			172,299	31,722
1972	Nov. 18-26	9	Unit System			186,708	30,084
1973	Nov. 17-25	9	Unit System			210,770	33,438
1974 [2]	Nov. 16-24	9	Unit System			213,191	29,262
1975 [3]	Nov. 15-23	9	Unit System			234,471	51,823

Table 1 cont'd. Firearms deer hunting season and harvest summary from 1944-2012.

Year	Season Dates	Days	Regulation System	Permits Sold	Harvest
1976	Nov. 13-21	9	Unit System	232,765	40,683
1977	Nov. 19-27	9	Unit System	250,192	36,562
1978 [4]	Nov. 18-26	9	Unit System	246,803	40,261
1979	Nov. 17-25	9	Unit System	268,275	53,164
1980 [5]	Nov. 15-23	9	Unit System	269,110	49,426
1981	Nov. 14-22	9	Unit System	267,826	50,183
1982	Nov. 13-21	9	Unit System	275,182	55,852
1983	Nov. 12-20	9	Unit System	287,669	57,801
1984	Nov. 10-18	9	Unit System	296,334	71,569
1985	Nov. 16-24	9	Unit System	320,318	80,792
1986 [6]	Nov. 15-23	9	Unit System	339,323	102,879
1987 [7]	Nov. 14-22	9	Unit System	375,262	132,500
1988 [8]	Nov. 12-20	9	Unit System	408,761	136,726
1989	Nov. 11-19	9	Unit System	425,564	157,506
1990	Nov. 10-18	9	Unit System	444,315	161,857
1991	Nov. 16-24	9	Unit System	446,569	149,112
1992	Nov. 14-22	9	Unit System	451,173	150,873
1993	Nov. 13-21	9	Unit System	460,575	156,704
1994	Nov. 12-20	9	Unit System	462,588	163,468
1995	Nov. 11-21	11	Unit System	476,483	187,406
1996 [9]	Nov. 16-26	11	Unit System	505,540	190,770
	Jan. 4-5	2			
1997	Nov. 15-25	11	Unit System	548,071	196,283
	Jan. 3-4	2			
1998	Nov. 14-24	11	Unit System	514,337	202,679
	Jan. 2-5	4			
1999[10]	Nov. 13-23	11	Unit System	524,668	194,991
	Dec. 4-12	9			
	Jan. 8-11	4			
2000	Nov. 11-21	11	Unit System	546,754	220,495
	Dec. 2-10	9			
	Jan. 6-9	4			

Table 1 cont'd. Firearms deer hunting season and harvest summary from 1944-2012.

Year	Season Dates	Days	Regulation System	Permits Sold	Harvest
2001 [11]	Oct. 27-28	2	Unit System	578,883	235,000
	Nov. 10-20	11			
	Dec. 1-9	9			
	Jan. 5-8	4			
2002	Nov. 2-3	2	Unit System	596,431	247,826
	Nov. 16-26	11			
	Dec. 7-15	9			
	Dec. 19-22	4			
2003 [12]	Oct. 25-26	2	Unit System	622,488	254,814
	Nov. 1-2	2			
	Nov. 15-25	11			
	Nov. 28-Dec. 7	9			
	Dec. 13-21	9			
2004	Oct. 8-11	4	County System	565434 [13]	275,015
	Nov. 6-7	2			
	Nov. 13-23	11			
	Nov. 26-Dec. 5	9			
	Dec. 11-19	9			
2005	Oct. 7-10	4	County System	568,244	248,689
	Oct. 29-30	2			
	Nov. 12-22	11			
	Nov. 25-Dec. 4	9			
	Dec. 10-18	9			
2006	Oct. 6-9	4	County System	586,609	281,030
	Oct. 28-29	2			
	Nov. 11-21	11			
	Nov. 24-Dec. 3	9			
	Dec. 9-17	9			
2007	Oct. 5-8	4	County System	577,375	258,976
	Oct. 27-28	2			
	Nov. 10-20	11			
	Nov. 23-Dec. 2	9			
	Dec. 8-16	9			

Table 1 cont'd. Firearms deer hunting season and harvest summary from 1944-2012.

Year	Season Dates	Days	Regulation System	Permits Sold	Harvest
2008 [14]	Oct. 3-6	4	County System	597,261	237,253
	Nov. 1-2	2			
	Nov. 15-25	11			
	Nov. 28-Dec. 7	9			
	Dec. 13-21	9			
	Jan. 3-4	2			
2009	Oct. 9-12	4	County System	596,654	245,945
	Oct. 31-Nov. 1	2			
	Nov. 14-24	11			
	Nov. 25-Dec. 6	12			
	Dec. 19-29	11			
	Jan. 2-3	2			
2010	Oct. 8-11	4	County System	588,037	230,162
	Oct. 1-31	2			
	Nov. 13-23	11			
	Nov. 24-Dec. 5	12			
	Dec. 18-28	11			
	Jan. 21-22	2			
2011	Oct. 7-10	4	County System	590,534	237,264
	Nov. 5-6	2			
	Nov. 12-22	11			
	Nov. 23-Dec. 4	12			
	Dec. 17-27	11			
	Jan. 7-8	2			
2012	Oct. 5-8	4	County System	599,200	256,971
	Nov. 3-4	2			
	Nov. 10-20	11			
	Nov. 21-Dec. 2	12			
	Dec. 15-25	11			
	Dec. 29-30	2			

[1]Deer Management Unit system initiated - ten (10) units established.
[2]Quota system established in limited units and number of units increased to eleven (11).
[3]Number of units increased to twelve (12).
[4]Number of units increased to twenty-three (23).
[5]Quota system expanded to statewide.
[6]Number of units increased to fifty-seven (57).
[7]Bonus Antlerless-only Deer permit system initiated.
[8]Beginning this year, muzzleloading permits and harvest are included in totals.
[9]January Extension initiated and number of units increased to fifty-nine (59).
[10]Beginning this year, muzzleloading portion is part of the firearms deer hunting season.
[11]Beginning this year a two-day Youth-Only Portion of the firearms season was implemented
[12]Urban portion implemented.
[13]Reduction in permit sales attributed to liberalized issuance of permits to landowners.
[14]Youth-only portion expanded to include two weekends.

Table 2. Archery deer hunting season and harvest summary from 1946-2012.

Year	Season Dates	COUNTIES OPEN		PERMITTEES			Harvest
		Bucks -Only	Any-Deer	Total	Resident	Non-Resident	
1946	Oct. 24-26	1	0	73	73	0	0
1947	Oct. 28-Nov. 1	1	0	39	39	0	0
1948	Nov. 29-Dec. 4	1	0	62	62	0	0
1949	Nov. 26-Dec. 4	1	0	54	54	0	0
1950	Nov. 13-22	1	0	64	64	0	1
1951	Oct. 22-24	0	1	77	77	0	0
1952	Oct. 16-31	0	5	214	214	0	2
1953	Oct. 16-31	0	41	481	481	0	5
1954	Oct. 1-31	0	44	1,053	1,052	0	22
1955	Oct. 1-31	8	53	1,506	1,506	0	37
1956	Oct. 1-31	9	54	2,075	2,075	0	33
1957	Oct. 1-Nov. 30	13	50	2,720	2,563	157	58
1958	Oct. 1-Dec. 15	13	50	3,670	3,475	195	71
1959	Oct. 1-Dec. 15	50	54	4,495	4,221	274	90
1960	Oct. 1-Dec. 15	51	53	4,468	4,152	316	263
1961	Oct. 1-Dec. 15	50	54	5,190	4,850	340	116
1962	Oct. 1-Dec. 15	12	92	6,035	5,736	299	231
1963	Oct. 1-Dec. 15		Statewide	7,324	6,974	350	268
1964	Oct. 1-Dec. 15		Statewide	9,559	9,169	390	316
1965	Oct. 1-Dec. 15		Statewide	10,756	10,381	375	371
1966	Oct. 1-Dec. 15		Statewide	11,878	11,489	389	458
1967	Oct. 1-Dec. 15		Statewide	13,561	13,121	440	380
1968	Oct. 1-Dec. 15		Statewide	15,510	14,924	586	559
1969	Oct. 1-Dec. 31		Statewide	14,709	14,202	507	619
1970	Oct. 1-Dec. 31		Statewide	16,950	16,478	472	828
1971	Oct. 1-Dec. 31		Statewide	17,840	17,413	427	962
1972	Oct. 1-Dec. 31		Statewide	21,493	20,841	652	1,130
1973	Oct. 1-Nov. 16 Nov. 26-Dec. 31		Statewide	25,254	24,508	746	1,285
1974	Oct. 1-Nov. 15 Nov. 25-Dec. 31		Statewide	27,871	27,015	856	1,437
1975	Oct. 1-Nov. 14 Nov. 24-Dec. 31		Statewide	29,974	28,948	1,026	1,850

Table 2 cont'd. Archery deer hunting season and harvest summary from 1946-2012.

Year	Season Dates	COUNTIES OPEN		PERMITTEES			Harvest
		Bucks-Only	Any-Deer	Total	Resident	Non-Resident	
1976	Oct. 1-Nov. 12 Nov. 22-Dec. 31		Statewide	31,281	30,098	1,183	1,973
1977	Oct. 1-Nov. 18 Nov. 28-Dec. 31		Statewide	33,239	31,932	1,307	2,199
1978	Oct. 1-Nov. 17 Nov. 27-Dec. 31		Statewide	34,368	33,197	1,171	2,781
1979	Oct. 1-Nov. 16 Nov. 26-Dec. 31		Statewide	41,115	39,830o	1,285	3,327
1980	Oct. 1-Nov. 14 Nov. 26-Dec. 31		Statewide	46,548	44,923	1,625	3,661
1981	Oct. 1-Nov. 13 Nov. 23-Dec. 31		Statewide	46,776	45,096	1,680	3,495
1982	Oct. 1-Nov. 12 Nov. 22-Dec. 31		Statewide	47,931	46,132	1,799	4,191
1983	Oct. 1-Nov. 11 Nov. 21-Dec. 31		Statewide	52,666	50,742	1,924	4,626
1984	Oct. 1-Nov. 9 Nov. 19-Dec. 31		Statewide	56,378	55,178	1,200	5,134
1985	Oct. 1-Nov. 15 Nov. 25-Dec. 31		Statewide	62,731	61,494	1,237	5,621
1986	Oct. 1 -Nov. 14 Nov. 24-Dec. 31		Statewide	69,265	67,927	1,338	5,832
1987	Oct. 1-Nov. 13 Nov. 2-Dec. 31		Statewide	75,074	73,615	1,459	8,077
1988	Oct. 1-Nov. 11 Nov. 21-Dec. 31		Statewide	82,612	81,213	1,399	10,183
1989	Oct. 1-Nov. 10 Nov. 20-Dec. 31		Statewide	83,440	82,099	1,341	10,970
1990	Oct. 1-Nov. 9 Nov. 19-Dec. 31		Statewide	83,723	82,471	1,252	11,118
1991	Oct. 1-Nov. 15 Nov. 25-Dec. 31		Statewide	91,656	90,294	1,362	14,096
1992	Oct. 1-Nov. 13 Nov. 23-Dec. 31		Statewide	94,809	93,308	1,501	15,029
1993	Oct. 1-Nov. 12 Nov. 22-Dec. 31		Statewide	93,729	92,171	1,558	14,696
1994	Oct. 1-Nov. 11 Nov. 21-Dec. 31		Statewide	97,441	95,595	1,846	17,136

Table 2 cont'd. Archery deer hunting season and harvest summary from 1946-2012.

Year	Season Dates	COUNTIES OPEN		PERMITTEES			Harvest
		Bucks -Only	Any-Deer	Total	Resident	Non-Resident	
1995	Oct. 1-Nov. 10 Nov. 22-Jan. 15		Statewide	98,601	96,588	2,013	20,077
1996	Oct. 1-Nov. 15 Nov. 22-Jan. 15		Statewide	101,494	99,291	2,203	23,566
1997	Oct. 1-Nov. 14 Nov. 26-Jan. 15		Statewide	93,402	91,049	2,353	20,915
1998	Oct. 1-Nov. 13 Nov. 25-Jan. 15		Statewide	96,373	93,792	2,581	21,190
1999	Oct. 1 -Nov. 12 Nov. 24-Jan. 15		Statewide	97,351	94,897	2,454	23,510
2000	Oct. 1-Nov. 10 Nov. 22-Jan. 15		Statewide	96,980	94,484	2,496	23,558
2001	Oct. 1-Nov. 9 Nov. 21-Jan. 15		Statewide	97,883	95,124	2,759	26,273
2002	Oct. 1-Nov. 15 Nov. 27-Jan. 15		Statewide	99,630	96,649	2,981	29,587
2003	Oct. 1-Nov. 14 Nov. 26-Jan. 15		Statewide	101,821	98,374	3,447	33,526
2004	Sept. 15-Nov. 12 Nov. 24-Jan. 15		Statewide	94,473	90,243	4,246	37,646
2005	Sept. 15-Nov. 11 Nov. 23-Jan. 15		Statewide	90,897	85,864	5,033	36,594
2006	Sept. 15-Nov. 10 Nov. 22-Jan. 15		Statewide	96,973	90,895	6,078	40,898
2007	Sept. 15-Nov. 9 Nov. 21-Jan. 15		Statewide	95,817	89,103	6,714	39,387
2008	Sept. 15-Nov. 14 Nov. 26-Jan. 15		Statewide	100,448	93,403	7,045	42,802
2009	Sept. 15-Nov. 13 Nov. 25-Jan. 15		Statewide	107,222	99,840	7,382	49,010
2010	Sept. 15-Nov. 12 Nov. 24-Jan. 15		Statewide	106,440	98,688	7,752	42,372
2011	Sept. 15-Nov. 11 Nov. 23-Jan. 15		Statewide	112,513	104,568	7,945	49,530
2012	Sept. 15-Nov. 9 Nov. 21-Jan. 15		Statewide	118,379	109,967	8,412	51,008

Missouri Public Land Deer Management

Management of deer on public areas has had a diverse history. Beginning in 1944, the Missouri Department of Conservation maintained a number of refuges within public areas to protect a segment of the deer population. Entire portions of other public areas were open to statewide regulations. In 1966, MDC staff recognized that many public areas open to statewide deer regulations had deer herds that were "depleted by heavy hunting pressure". A managed deer hunt program was designed with the primary objective being the "best long-term utilization of herds ranging on state lands". Since then this program has grown to include in 2010, 98 hunts on 44 areas. Other means of regulating deer harvest on public land have evolved: 1) Antlered-only regulations, where the only legal deer during the entire firearms season is antlered; 2) Partial refuges where part of an area is closed during the firearms season; 3) Archery methods only are legal; 4) Archery and muzzleloading methods only are legal; 5) No antlerless permits can be used.

A 2001-2002 pilot study conducted to measure hunter activity and satisfaction on three public areas (Davisdale, Fountain Grove, Union Ridge) with different deer hunting regulations in northeast Missouri revealed that considerable differences in hunter activity, success and satisfaction occurred among the conservation areas. Davisdale and Fountain Grove had greater use and produced more harvested deer per unit area than Union Ridge. This was surprising given that harvest opportunity was more restricted, only antlered bucks could be taken during the firearms season on Davisdale, and only archery methods could be used on Fountain Grove. Hunters using Davisdale and Fountain Grove were more satisfied with their hunt and were more likely to return the following year than hunters on Union Ridge. These differences in success and satisfaction were probably most influenced by deer abundance. Deer abundance on public areas within geographic regions is mostly a function of deer hunting regulations. On Davisdale, archers took some antlerless deer, but most deer were protected from excessive exploitation that occurs during the firearms season. Archers are less effective at taking deer so pressure on all segments of the deer population on Fountain Grove was relatively low. Union Ridge was open to statewide regulations. With increasingly liberal opportunities to take antlerless deer during statewide hunting seasons, mortality rates on public areas such as Union Ridge probably have become greater than can be sustained by the local population.

Hunter attitude mail surveys also reveal possible developing problems with too many antlerless deer being taken on public land. The percentage of deer hunters in Missouri who hunt public land at some time during the firearms season declined to a low in 2001 and has increased slightly since then (39%, 29%, 20%, 18%, 21%, 24%, and 13% in 1971, 1978, 1991, 2001, 2006 2010, and 2012 respectively). Hunter success is lower for those hunting mostly or entirely on public areas compared to those hunting mostly or entirely on private land (in a 2008 hunter attitude survey 65% and 50%, respectively, do not take a deer) and perceptions that there are too few deer are higher for persons hunting public land than private land (in 2008 hunter attitude survey 59% and 40%, respectively, felt there were too few deer). As a result, public lands deer hunters tend to rate their hunting experience lower than private land hunters (in 2008 hunter attitude survey 67% and 51%, respectively, rated their 2008 hunt as fair or poor).

Based on results from the 2001 and 2002 pilot study, mail surveys, and input from field staff, the Regulations Committee asked Wildlife and Forestry Divisions to recommend deer hunting regulations for the 2005 deer seasons that "provide deer hunters a geographically-balanced diversity of hunting opportunities and to sustain deer populations at or above average

densities on private land within the county". Potential deer regulations included: 1) Statewide regulations; 2) Statewide regulations except firearms and archery antlerless permits could not be used and area is closed to deer hunting during the urban and antlerless portions of the firearms deer season ; 3) Statewide regulations except firearms and archery antlerless permits could not be used and area is open for deer hunting during the urban and antlerless portions of the firearms deer season ; 4) Statewide archery regulations (except no archery antlerless permits could be used), antlered deer only during the firearms season ; 5) Statewide regulations, except archery and muzzleloader methods only; 6) Statewide regulations, except archery methods only ; and 7) Managed hunts, which could be used in combination with other deer hunting regulations. As a result of these directives, deer regulations changed on many conservation areas for the 2005 deer seasons. As a result of this pilot study, a full research project was conducted in 2005-2006 and 2011-2012 to evaluate regulation effects of deer populations, hunter success, and hunter satisfaction, as of January 2014 the results are being analyzed and summarized. We continue to monitor deer populations, and hunter activities and satisfaction on select Conservation Areas across Missouri.

History of Landowner Privileges

Landowners play a major role in our deer management program and, as a result, have some privileges which have evolved over time. The history of landowner privileges follows:

1944–1974
During this period counties (1944–1969) or units (1970–1974) were annually designated as Bucks-Only or Any-Deer. A farmer could farm tag (take on his/her property without a permit), during both the firearms and archery seasons, an antlered buck in Bucks-Only counties (units) and any deer in counties (units) in which an Any-Deer season was held. The definition of farmer was more exclusive than today. Farmers included owners and lessees residing on land that was used primarily for agricultural purposes. Landowners living off of the property or who did not participate in the farming operation were excluded from this privilege.

> Farmer: "Any bona fide owner or lessee of lands, or his permanently employed hired hand, or any member of the immediate household of such owner, lessee, or employee within the state, who is a citizen of the state and who actually resides upon and operates such land exclusively for agricultural purposes."

1975
The quota system was implemented in some deer management units. A farmer (*as defined earlier*) could take, without a permit, an antlered deer in Bucks-Only units and any deer in quota or Any-Deer units.

1979
A farmer (*as defined earlier*) could take, without a permit, an antlered deer in Bucks-Only units or any deer in quota or Any-Deer units. In quota deer management units, a person who owned at least 80 acres, plus one member of the household, could apply for and receive a landowner Any-Deer permit. To quality for these permits, the landowner did not have to live on the property as s/he did in order to farm tag a deer.

1980
The farmer definition was liberalized. The owner of the farm did not have to live on the land to take an antlered deer in Bucks-Only units or any deer in quota units. Landowners of at least 80 acres could still get Any-Deer permits as before.

> Farmer: "Any Missouri resident who is an owner of lands he personally and physically operates primarily for agricultural purposes, the lessee or operator residing on such lands, or any member of the immediate household of such owner-operator or resident lessee or operator."

1982
Landowner Any-Deer permits were discontinued because the change in the farmer definition in 1980 had made most landowners eligible to take antlerless deer on a farm tag. The landowner Any-Deer permit was considered to be redundant.

1983
Landowner regulations became more restrictive because the change in the farmer definition in 1980 had resulted in an increasing proportion of does being taken by landowners (18% in 1979 and 46% in 1982). As a result, permittee quotas had to be reduced by almost one-half. In 1983 a landowner was defined as an owner of at least 75 acres in one continuous tract. Only landowners of this minimum acreage could farm tag a deer and, unlike before, it had to be an antlered buck. A landowner with a minimum of 75 acres could also apply for one Any-Deer permit. Lessees living on at least 75 acres could farm tag a buck but were not eligible for landowner Any-Deer permits.

> Landowner: "Any Missouri resident who is the owner of seventy-five (75) acres or more in one continuous tract or any member of the immediate household of such owner. In the case of corporate ownership, this definition shall apply only to those corporate owners who reside on lands held by the corporation."

1984
In response to public criticism, but in opposition to an MDC committee recommendation not to change landowner deer hunting regulations, the Director, with Commission approval, reduced the minimum acreage requirement to 5 acres to qualify as a landowner. Thus a landowner of at least 5 acres could take an antlered buck without a permit. An acreage formula was established for landowner Any-Deer permits: 75 acres for one Any-Deer permit; 300 for two' and 1000+ for three.

> Landowner: "Any Missouri resident who is the owner of five (5) acres in one (1) continuous tract devoted, in part, to agricultural crop production, livestock grazing, hayfields or woodlands, or who develops wildlife habitat on said land, or any member of the immediate household of such owner. In the case of corporate ownership, this definition shall apply only to those corporate shareholders who reside on lands held by the corporation."

1987
Bonus antlerless-only permits were issued for the first time. Landowners in each unit were guaranteed one-half of the bonuses available. As a result, landowners had a much better chance of getting bonuses than permittees.

1995
All landowner permits could be used in the firearms and muzzleloading firearms season. The deer rule specified that corporate shareholders were not required to reside on the land to qualify for no-cost landowner Any-Deer and Bonus Deer permits.

> Landowner: "Any Missouri resident who is the owner of five (5) acres in one (1) continuous tract, or any member of the immediate household whose legal residence or domicile is the same as the landowner's for at least thirty (30) days last past. Except as provided in 3CSR10-7.435, in the case of corporate ownership, this definition shall apply only to those corporate shareholders who reside on lands held by the corporation."

1996
The acreage formula was liberalized: 75 acres for 1 combination of Any-Deer and Bonus Deer permits; 150 acres for two; 300 acres for three; and 600+ acres for four.

1997
Landowners no longer competed with permittees for Bonus Deer permits. If any permittee bonuses were issued in a unit, all landowners were guaranteed to receive them.

1998
In the case of corporate ownerships, the definition of landowner was interpreted such that ownership of common stock does not convey corporate shareholder (*i.e.*, legal landowner) status. In some units landowners received bonus permits but none were available to regular permittees.

2001
In the case of corporate ownerships, the deer rule specified that up to four (4) officers of the corporation could be considered as legal landowners. Also, both "resident" and "nonresident" landowners were defined.

> Resident Landowner: "Any Missouri resident who is the owner of five (5) acres in one (1) continuous tract, or any member of the immediate household whose legal residence or domicile is the same as the landowner's for at least thirty (30) days last past. Except as provided in 3CSR10-7.435, in the case of corporate ownership, this definition shall apply only to those corporate shareholders who reside on lands held by the corporation."
>
> Nonresident Landowner: "Any nonresident of Missouri who is the owner of at least seventy-five (75) acres in one (1) continuous tract in the state of Missouri, or any member of the immediate household whose legal residence and domicile is the same as the nonresident landowner's for at least thirty (30) days last past. Corporate ownerships do not apply under this definition."

A maximum of three deer could be taken during the firearms deer season, regardless of whether a person was a landowner or regular permittee.

2003
The acreage formula was eliminated so that for a landowner with at least 75 acres, any member of the household could obtain an any-deer permit and, if available, bonus permits. The landowner bag limit was liberalized. For the first time, a landowner could take deer on landowner bonus and purchased bonus permits. In other words, they could fill any bonus permit held. Also, a landowner could farm tag a deer of either sex rather than only an antlered buck.

2004
Landowners did not have to apply for their deer permits by mail, but could obtain them from a POS vendor. All landowners had to obtain a permit; farm tags were eliminated. Landowners could now fill landowner any-deer and purchased any-deer permits with the exception than only one antlered buck could be taken. Landowners could also telecheck their deer.

2005
Landowners with 75 or more acres in more than one county had to conform to landowners antlerless bag limits for each county in which their land was located.

2009
Nonresident landowners no longer can obtain discounted deer hunting permits.

2010-2013
Currently landowners of from 5-74 acres receive free of charge one landowner firearms any-deer permit, one landowner archer's hunting permit and two landowner archery antlerless deer hunting permits (depending on county availability). Landowners with 75 or more acres also get up to two resident landowner firearms antlerless permits (depending on county availability). Landowners can also purchase and use additional deer permits with the exception that only one antlered buck can be taken during the firearms season and a maximum of two antlered bucks can be taken during the archery season.

IMPORTANCE OF DEER TO MISSOURI

Social and Economic Impact of Deer

The white-tailed deer is the most popular game animal in North America and generates approximately $76 billion in economic activities in the United States. In Missouri, deer hunting is not only a popular activity but it is also an important contributor to the Missouri economy. In 2012, more than 517,000 individuals possessed some form of a Missouri deer hunting permit (Figure 2). Survey results indicate that Missouri deer hunters, aged 16 years or older, spent 7,295,239 days hunting and had total annual expenditures of $470,664,590. In addition to hunting, many Missourians also enjoy viewing and feeding deer. The annual expenditures associated with deer and deer hunting activities results in a total annual economic impact of $765,926,811 in Missouri (Southwick Associates 2013). The expenditures related to deer

hunting in 2011 supported 8,494 jobs in Missouri that had an annual earnings total of $262,085,078. In addition, the expenditures related to deer hunting in 2011 generated $53,163,206 in state and local sales tax revenues, and $61,766,548 in federal tax revenues (Southwick Associates 2013).

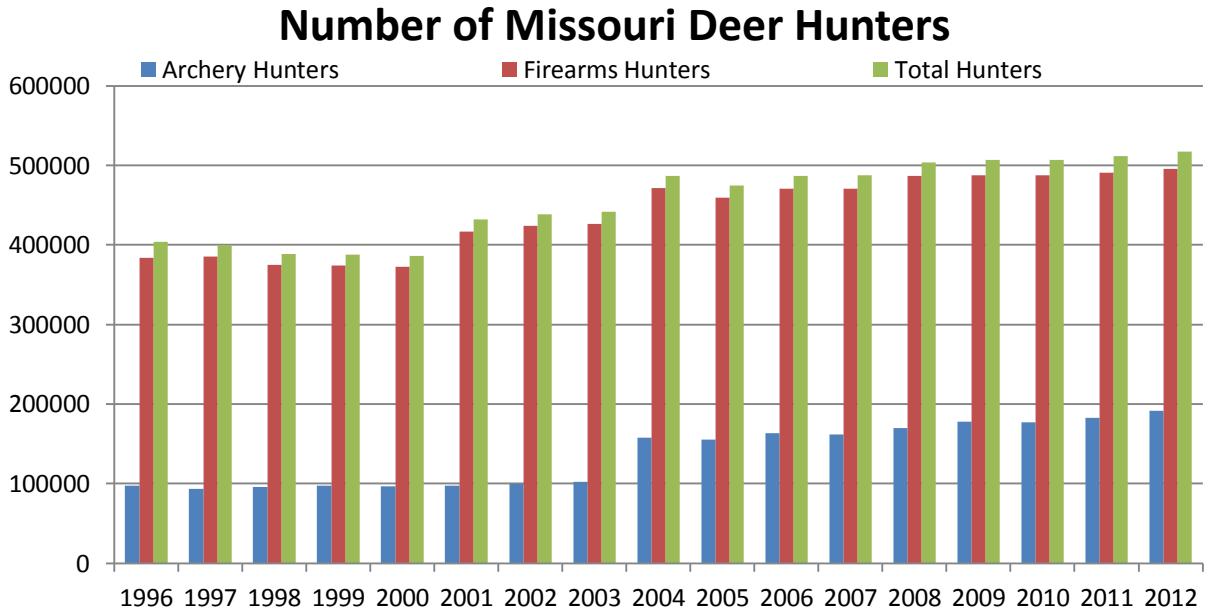


Figure 2. Number of archery, firearms and total combined deer hunters in Missouri from 2004-2012.

In the state of Missouri in permit year 2012, 774,906 Deer Hunting Permits (including firearms permits, archery permits, and managed hunt permits) were sold for a total amount of $15,070,704.

Public Attitudes Toward Deer and Deer Management

Attitudes toward deer and deer management are as diverse as the Missouri landscape. As management strategies to reduce deer numbers in many locations across Missouri continued through the last decade, hunter and landowner attitudes toward the overall success of Missouri's deer management program (Figure 3) and deer numbers (Figure 4, 5, & 6) have changed substantially. Regional and local differences in attitudes toward deer vary as a reflection of differences in tolerance of deer and differences in deer abundance (Figures 5 & 6).

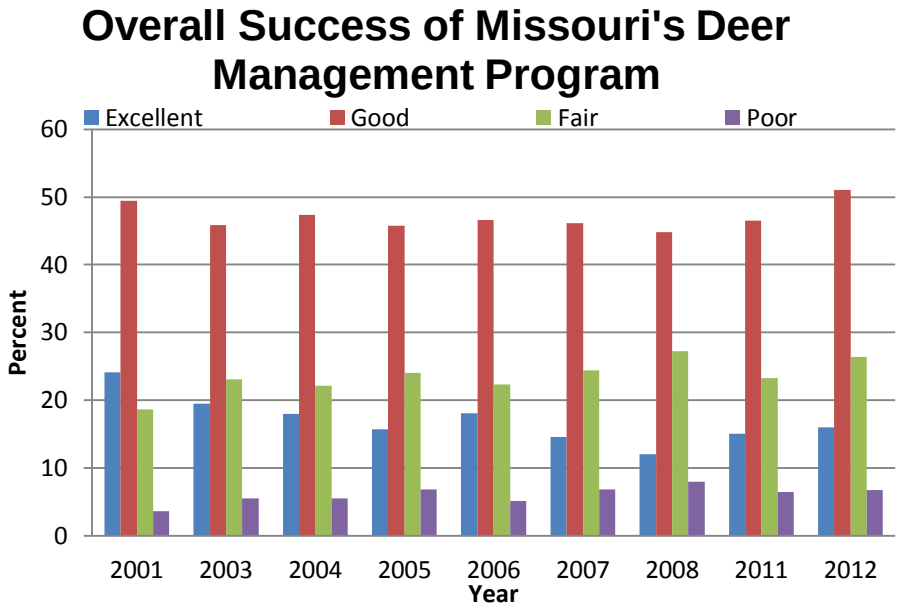


Figure 3. Attitudes of Missouri Hunters and Landowners toward the success of Missouri's Deer Management Program.

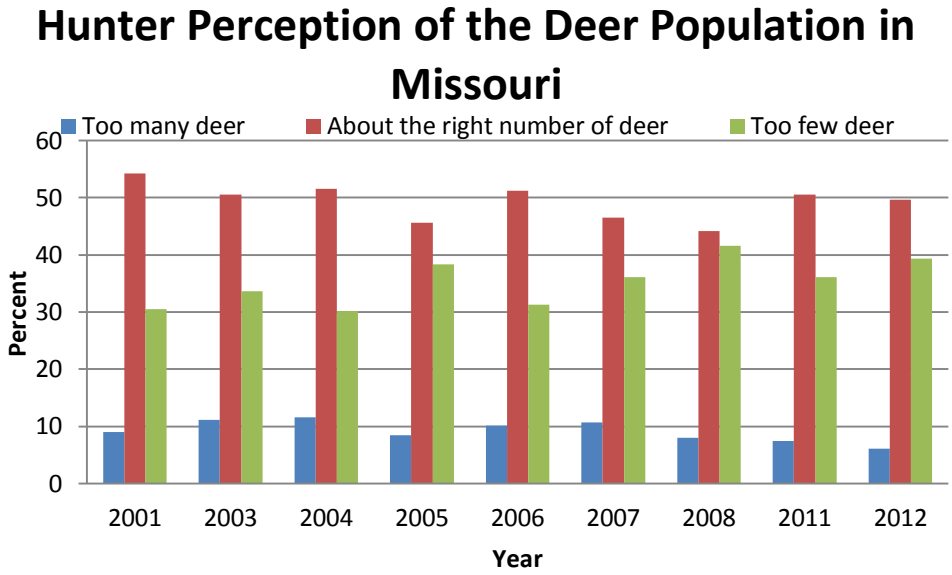


Figure 4. Missouri deer hunter perceptions about the size of the deer populations from 2001 to 2012.

Lower deer populations are reflected in landowner and hunter attitudes concerning deer abundance (Figure 5 & 6). In general, the shift in attitudes towards the deer population across many parts of Missouri has been dramatic in the last 8 years, which includes an increase in the percentage of hunters and production landowners who perceive that there are too few deer.

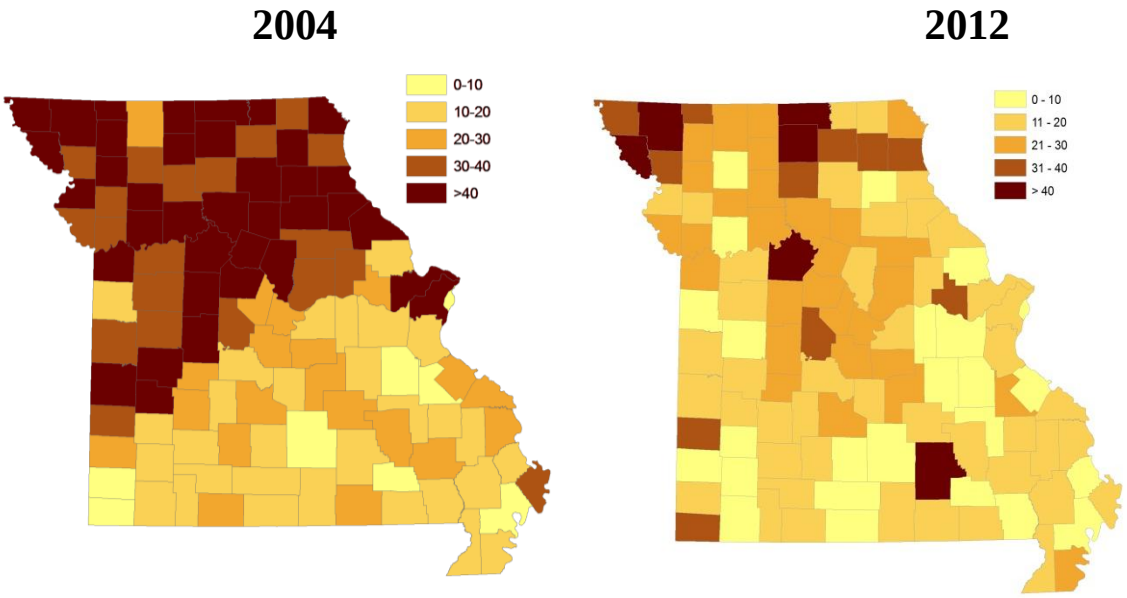


Figure 5. Percentage of production landowners surveyed in 2004 and 2012 that feel there are too many deer.

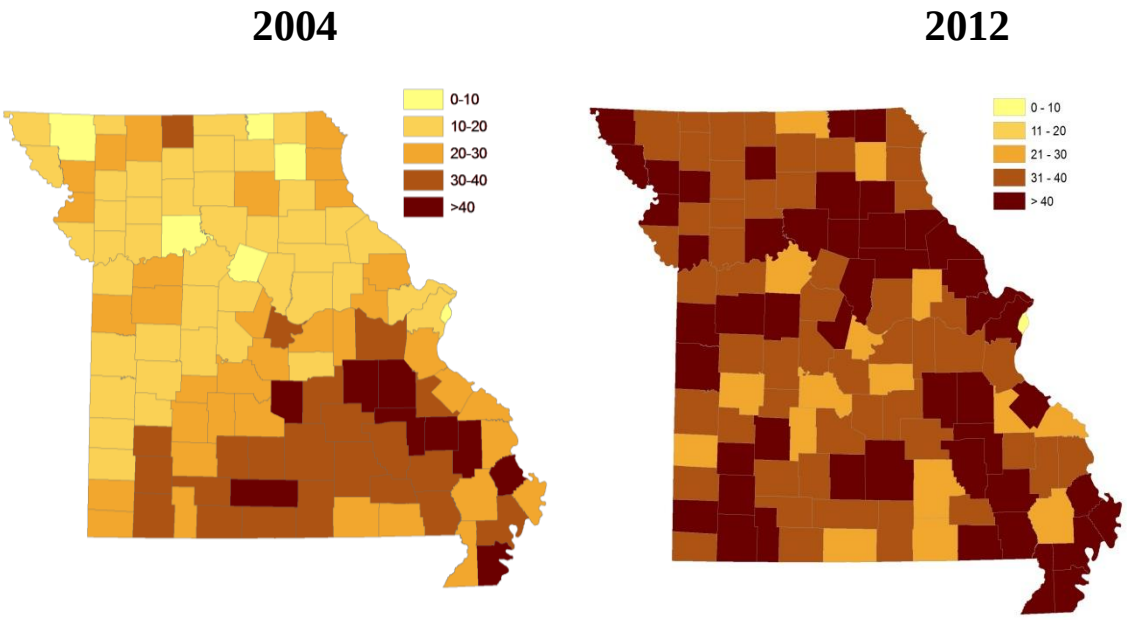


Figure 6. Percentage of hunters surveyed in 2004 and 2012 that feel there are too few deer.

Share the Harvest

The Share the Harvest program in Missouri provides a way for deer hunters to donate venison to the needy. This program is administered by the Conservation Federation of Missouri and the MDC. During the 2012 deer seasons, 6,244 hunters donated approximately 318,115 pounds of venison. Since the inception of the program more than 20 years ago, more than 2 million pounds of venison have been donated to feed the less fortunate.

HUMAN-DEER CONFLICTS

Agricultural Damage

Deer browsing can cause significant impacts to agricultural crops, orchards, nurseries, and ornamental plants. When highly nutritious crops are available and accessible, deer have adapted to utilizing them even when other food sources are available. Damage to agricultural crops occurs anywhere there are deer and crops with the greatest intensity of damage occurring in areas with high deer populations and agricultural crops are more prevalent. Many agricultural crops can sustain a low level of browsing pressure without significant consequences, while other plants are more sensitive to any browsing pressure. Tolerance levels of deer damage also varies greatly among producers and may be dependent upon the weather during the growing season. For example, during the hot and dry summer of 2007, 54 authorizations to destroy deer were issued, more than double the 10-year average (Figure 7). Additionally, increased prices of commodities may also reduce the tolerance of some producers to deer damage.

The Department has attempted to minimize deer damage using both lethal and non-lethal means. Legal harvest during open hunting seasons is the first option for management of deer damage. Liberalization of hunting regulations such as season lengths and availability of antlerless permits have greatly increased the ability for individual landowners to reduce numbers through legal harvest in much of the state. Landowners and hunters currently have more than 120 days, including more than 35 days of firearms hunting, to harvest antlerless deer. Limited access or reluctance of landowners to implement sufficient antlerless harvest during the hunting season is a common culprit in deer damage complaints. In situations where immediate damage relief is needed, authorizations to destroy permits are issued to individual landowners by conservation agents and wildlife damage specialist.

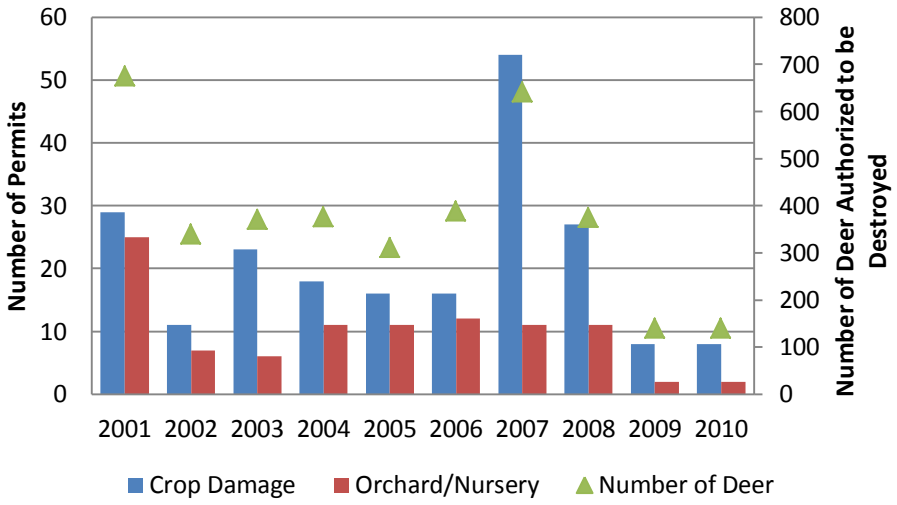


Figure 7. Authorizations to destroy deer because of crop or orchard and nursery damage from 2001-2010.

Deer-Vehicle Collisions

With increasing deer densities and development of highway systems encroaching upon deer habitat in more rural areas, deer-vehicle collisions have become more prevalent over the last several decades (Figure 8; Table 3). Deer-vehicle collisions vary over time as driving behavior and deer densities change but also within a year as factors influence deer behavior (Figure 9). The highest incidence of deer-vehicle collisions coincides with the peak of the breeding season, a time at which both bucks and does are very active as they seek mates. Additionally, despite changes in the deer population and driving behavior over the last couple of decades the proportion of all vehicle accidents that involve deer has remained stable (Figures 10 and 11).

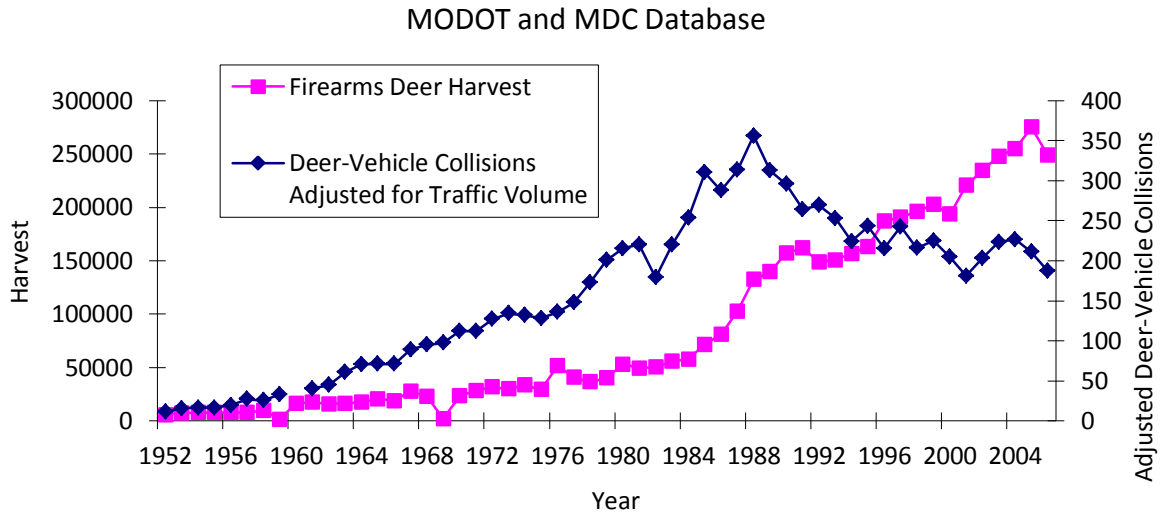


Figure 8. Frequency of deer-vehicle collisions and firearms deer harvest in Missouri from 1952-2004.

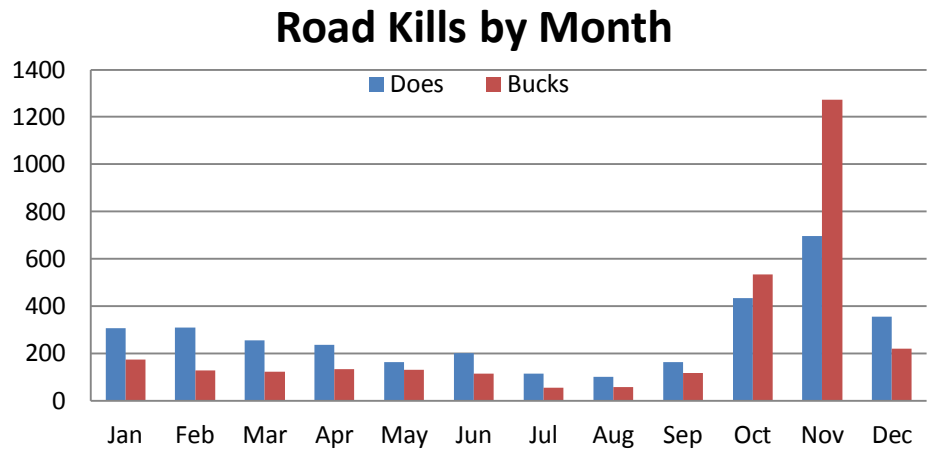


Figure 9. Distribution of road killed deer by month in 2009.

Table 3. Missouri Department of Transportation and Department of Conservation Deer Death Reports from 1976-2009.

Year	Hwy	Train	Fence	Dogs	Illegal	Disease	Crop Damage Permits	Unknown	Total
1976	2,960	9	118	34	529	19	70	72	3,811
1977	3,562	15	113	40	545	6	105	82	4,468
1978	4,335	12	117	60	594	3	106	1,058	5,332
1979	4,647	18	151	72	806	9	160	177	6,040
1980	3,975	10	131	46	558	164	139	201	5,224
1981	3,861	7	135	36	466	3	144	118	4,770
1982	4,779	17	151	30	801	6	125	140	6,049
1983	5,743	16	187	36	1,152	9	186	189	7,518
1984	7,373	0	258	47	1,305	22	336	233	9,574
1985	6,975	20	196	27	912	5	328	181	8,644
1986	8,020	17	212	33	770	10	304	175	9,541
1987	9,519	18	262	26	775	2	300	195	11,097
1988	8,764	16	219	44	766	1,457	432	360	12,058
1989	8,827	11	186	38	648	14	329	192	10,245
1990	8,075	8	188	31	544	6	279	115	9,246
1991	8,254	15	201	28	750	8	399	132	9,787
1992	8,096	7	224	37	672	8	288	109	9,441
1993	7,386	16	183	46	489	5	237	282	8,644
1994	8,384	13	187	35	669	8	311	114	9,721
1995	7,706	18	213	33	709	11	403	86	9,179
1996	8,827	12	195	36	731	28	180	325	10,334
1997	8,110	7	194	28	557	14	276	385	9,571
1998	8,651	10	196	20	580	1,625	52	471	11,605
1999	8,139	10	149	25	460	44	119	414	9,360
2000	7,049	10	191	23	457	23	51	415	8,224
2001	8,148	11	173	31	399	62	130	332	9,286
2002	9,041	12	170	23	440	20	149	453	10,308
2003	9,162	15	122	15	446	46	201	512	10,519
2004	8,648	15	118	11	523	22	442	622	10,401
2005	7,663	12	107	15	346	38	854	536	9,571
2006	7,661	23	119	12	531	22	591	664	9,623
2007	7,454	10	99	13	460	95	783	607	9,521
2008	5,950	10	120	19	541	31	392	956	8,019
2009	6,930	23	138	17	495	28	313	708	8,652

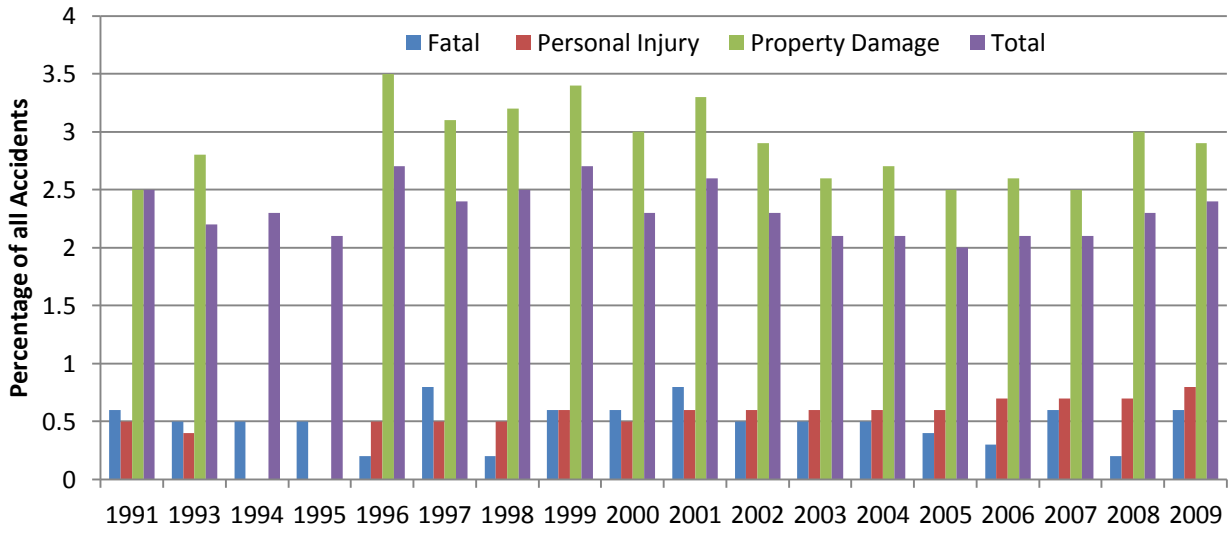


Figure 10. Percentage of all fatal, personal injury, and property damage accidents that involve deer (Missouri Department of Transportation).

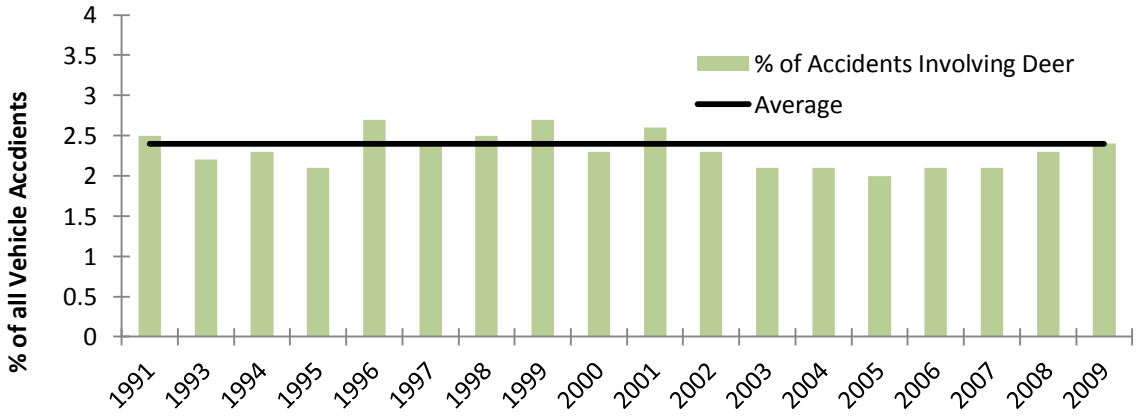


Figure 11. Percentage of accidents involving deer compared to the average from 1991-2009.

Urban Deer Conflicts and Management

Urban and suburban lands are areas that are highly settled or developed by humans. They may be residential, industrial, or a mix of both, sometimes sprinkled with "green areas" such as city or county parks, and cemeteries. In such areas, deer populations can expand to nuisance and damaging proportions with the overabundance of deer usually being a reflection of human values rather than biological thresholds (e.g., deer populations exceed the "social carrying capacity" but not the biological carrying capacity).

Many factors contribute to urban/suburban deer problems as follows: 1) high adaptability of white-tailed deer to human manipulated landscapes; 2) greatly reduced hunter harvest in urban/suburban settings caused by either prohibitive local ordinances or very low levels of access to properties where hunting can occur; 3) liability; 4) public relations concerns; 5) improved food and cover values resulting from residential lawns, ornamental tree and shrub

plantings, gardens, wooded subdivisions, golf courses, parks, and shrubby-wooded stream and highway corridors; 6) intentional feeding of deer; 7) isolation of deer resulting from construction of outerbelts, subdivisions, or other barriers that effectively reduce deer egress into rural areas; 8) real or perceived safety concerns with hunting as a deer management tool; 9) conflicting social attitudes and perceptions about deer management, and; 10) expansion of humans and human development (especially new roadways) into formerly rural settings. Under these conditions, deer nutrition is good, reproductive performance is high, mortality is low, and deer numbers invariably swell to nuisance proportions.

Typical areas of deer-human conflict in urban/suburban settings of Missouri include the following: 1) high incidence of deer-vehicle collisions and the associated safety risks and economic losses tied to these collisions; 2) damage to vegetable gardens; 3) damage to ornamental flower, shrub and tree plantings; 4) over browsing causing elimination of various plant species and resulting in reduced ecological diversity; 5) possible issues associated with diseases; 6) bold and aggressive behavior of deer that have habituated to humans and human environments, most notably does with young fawns, and; 7) potential deer starvation and death.

Extensive and continuing overlap in landscape use by people and deer has led to the enormous challenge of managing abundant deer populations in human-dominated environments, with a complex mix of human expectations, concerns, and values often expressed at the same time and place.

The goal of the MDC urban deer management is to provide individuals and communities with information about deer management control and to assist as requested in the management of white-tailed deer by providing management expertise, deer management plans, and population control options that provide residents and communities with effective ways to manage deer in accordance with the MDC Urban Deer Management Guidelines and all state, county, and municipal laws.

Extensive effort to inform and educate landowners is an essential aspect of managing deer in urban and suburban environments of Missouri. MDC staff for years has spent a considerable amount of time and effort working with urban and suburban landowners and community leaders regarding human-deer conflicts. These efforts typically suggest that a multi-faceted approach of lethal and non-lethal deer management strategies must be used as there is no single solution to alleviating all human-deer conflicts. Options offered and used in Missouri by landowners and communities include: non-lethal options such as habitat modification consisting of planting species non-palatable to deer and cutting roadside vegetation further away from the shoulder of the roadway, temporary and permanent fencing, no feeding ordinances, capture and surgical sterilization of female deer, and public awareness campaigns about cautious driving on Missouri's roadways. Lethal options utilized include ordinance changes allowing controlled hunting under statewide deer hunting regulations, implement or advise on implementing controlled hunts on public lands in urban and suburban areas, the establishment of urban zones and urban firearms, and archery deer seasons in Kansas City, Springfield, St. Louis, and Columbia/Jefferson City metropolitan areas, sharpshooting, and trapping and euthanasia. In 2013, MDC hosted the Urban Deer Summit in Missouri as an opportunity for the agency and community representatives to share information about urban and suburban white-tailed deer, discuss management strategies, solicit feedback about deer management issues, and cultivate relationships and communication among community representatives.

In summary, although urban and suburban deer management is a part of MDC's statewide deer management program, the variables noted in this section to some extent set urban and suburban deer management in a category by itself.

Ecological Impacts of Deer

Deer have the ability at high population density to over-browse the understory vegetation and alter the vegetative community. Intense browsing can reduce food and cover availability for deer as well as prevent forest regeneration. Over abundant deer populations have been implicated in the failure of many forests in the eastern US to regenerate and significantly modify the abundance of other herbaceous plants. In addition to decreasing the amount of food and cover, over-browsing by a deer population out-of-balance with the habitat can reduce the suitability of habitat for other wildlife species. Deer over-browsing on natural communities can have significant impacts by modifying the abundance and dynamics of vegetative communities. However, the most significant impacts are observed in poorly managed forests with prolonged periods of deer overabundance. Where deer populations are managed below the biological carrying capacity and active habitat management occurs, the impacts of deer on natural communities can be minimized.

Typically hunting pressure in much of Missouri is sufficient to keep deer populations below the biological carrying capacity of the environment and minimizes the negative ecological damage that over abundant deer populations cause. However, in some large Missouri State Parks and National Park Service properties where deer harvest is greatly restricted; ecological impacts of over abundant deer populations are a potential cause for concern. In these situations, many areas that are typically closed to hunting have traditionally managed deer numbers through special managed hunts. For example, the Missouri Department of Natural Resources annually surveys deer populations at various state parks across the state. When deer numbers exceed 25 deer per square mile they propose a managed hunt to control those populations. Therefore, while hunting does not occur on a regular basis it does occur frequently enough to minimize the potential for ecological damage.

ENFORCEMENT AND PROTECTION ISSUES

Regulations and the enforcement of game laws are critical to the sustainability of deer populations. Unregulated market hunting of the late 1800's and early 1900's nearly drove the white-tailed deer and several other game species to extinctions. It is important that the department create simple enforceable regulations that are effective in meeting the management goal while being easy to interpret by the hunting public. In addition regulations must be well accepted by the public or they will simply be rendered ineffective.

There are a number of enforcement and protection issues including:

- Tagging and reporting of deer
- Landowner privileges and verification of eligibility
- Baiting and feeding
- Clarity and enforceability of regulations

Each of these issues has individual complexities and details that are not appropriate for this basic review but will be given due consideration when developing the strategic deer plan.

DEER DISEASE

White-tailed deer are susceptible to a host of diseases and parasites. To date, only bovine tuberculosis (bTB), chronic wasting disease (CWD), hemorrhagic disease (HD), and tick borne pathogens are thought to be of concern to the deer population and public health. A disease outbreak regardless of real or perceived risk can have significant economic impacts and drive public concerns influencing deer management. For example, misinformation about the susceptibility of humans to CWD resulted in a significant decline in permit sales in Wisconsin following the finding of CWD in that state. In Michigan, it is believed that the bTB outbreak has cost the Michigan cattle industry more than $10 million dollars annually in addition to the millions of dollars spent on increased regulations and disease management in both domestic livestock and free-ranging deer.

Bovine Tuberculosis

Bovine tuberculosis is caused by a bacterium called *Mycobacterium bovis*. It is of primary concern because of its ability to infect a number of wild and domestic animals, including humans. In addition to cattle, deer are a proven reservoir for the disease. The disease is spread through the exchange of respiratory excretions from infected to uninfected individuals. The bacteria can be spread by infected animals coughing on uninfected animals or through the contamination of common food sources. Therefore, activities that congregate animals to a common location, such as baiting and supplemental feeding have been implicated in the spread of the disease among free-ranging deer and livestock. Reduction of population density and prohibition of feeding and baiting have been effective in significantly reducing the infection rate of bTB in endemic areas of Michigan. However, once established it seems highly unlikely that bTB will be eradicated from free-ranging deer populations.

Chronic Wasting Disease

Chronic wasting disease is a transmissible spongiform encephalopathy caused by infectious prions that attack the central nervous system of North America cervids. Surveillance and research indicate that once established CWD can obtain high prevalence rates resulting in decreased survival and potentially leading to significant population declines. The prions are spread from infected animals in body secretions such as blood, saliva, urine and feces. The sloughing of prions from live animals and presence of prions in carcasses represent an environmental contamination that can remain viable for several years. Because of this environmental contamination and prolonged infectious state within affected animals, once established within a population it is not believed that the disease can be eradicated.

Although there are still many questions about the nature of CWD transmission, there are two primary sources of exposure to CWD for uninfected deer: 1) CWD infected deer, and 2) CWD contaminated environment. There currently are no management strategies to eradicate CWD once the environment has been contaminated with infectious prions. Any management strategy should first focus on preventing the introduction of the disease because there is currently

no known management strategy that can effectively eradicate CWD from a population once it has become established.

Missouri has twenty-one confirmed cases of CWD in Linn and Macon counties, including eleven white-tailed deer within big game hunting preserves and ten free-ranging white-tailed deer. Missouri's first cases of CWD were detected in 2010 and 2011 in captive deer at private hunting facilities in Linn and Macon counties. Since that time, CWD has been found in 10 free-ranging deer within two miles of the captive facility in Macon County. Management efforts focused on minimizing the prevalence and spread of the disease include the testing of free-ranging deer throughout the state, restricting public feeding and revoking of the antler point restriction within the Containment Zone (6 county area), targeted culling in the Core Area (30 square-mile area), discouraging movement of harvested deer carcasses, and restricting the importation of harvested deer carcasses into Missouri. As of the summer for 2013, there were approximately 38,000 free-ranging deer tested for CWD statewide since 2001.

Hemorrhagic Disease

Hemorrhagic Disease is a group of closely related viruses, including epizootic hemorrhagic disease (EHD) and Bluetongue, which are often fatal infectious viral disease of deer spread via biting midges. Periodic large outbreaks of HD have occurred in Missouri, most notably, 1988, 1998, 2007, and 2012. Localized smaller outbreaks occur more frequently. HD is extremely lethal to white-tailed deer in Missouri and as a result can have significant localized population impacts. Although HD can drastically reduce local deer populations, the exact mortality rate is often impossible to determine immediately after an outbreak. There is no known treatment for the virus. The only known interrupter of a disease outbreak is the onset of cooler weather, specifically frost, which reduces the biting midge population stopping the vector of virus transmission. If a HD outbreak has lowered deer densities to undesirable levels, then reduced doe harvest should be considered to allow the population to rebound.

Tick-Borne Diseases

Tick-borne diseases (Lyme disease, Rocky Mountain spotted fever, Erlichiosis, etc.) impacts on deer populations are unknown but are a human health concern. These diseases are transmitted to humans by the bite of infected ticks. Deer are a host for the adult stage of tick and therefore, may play an important role in the exposure of humans to infectious ticks. While little is known about the actual role of deer populations in the transmission of tick-borne disease to humans, the public health concern makes it an important consideration.

STATEWIDE TRENDS

Current Deer Management Strategies

The Department strives to manage the deer population through science-based research with public input. Deer populations are monitored and managed at the county level by using a number of tools, such as Telecheck harvest counts, hunter and production landowner perceptions of the deer population, hunter effort, bowhunter observation indices, computerized "modeling" of county deer populations. This information allows MDC resource scientists to annually identify deer population levels and trends on a county basis (Figures 12-13). Subsequently, we manage populations at the county level through regulations, such as antlerless-harvest opportunities and antler-point restrictions. County regulations may vary because of land use characteristics (urban, rural, or agricultural practices), ownership patterns (public vs. private), hunter density, deer population, and hemorrhagic disease outbreaks.

Because hunting is the primary way we maintain desired deer numbers, we offer various deer-hunting opportunities. Missouri offers an archery season and a firearms season with various portions from mid-September to mid-January (Firearms season portions: urban zone, youth early and youth late, November, antlerless, and alternative methods).

One of the goals of deer regulation liberalization over the last decade has been to decrease deer numbers in many parts of Missouri. Implementation of the antlerless season, extending the length of the November portion of the firearms season and the APR were all intended to increase harvest pressure on does (Figure 14) to stabilize or reduce the deer populations. Modeling indicates that a harvest of 20-30 percent of the adult does in the population is sufficient to stabilize populations. If increased harvest pressure on does results in fewer does in the population then the number of deer that need to be harvested would also be reduced overtime. In some areas, the APR also reduces harvest pressures on bucks and has the potential to increase the number of bucks in the population overtime. Therefore, it is quite possible that a situation could arise in which the same number of deer are present in a population but the proportion of does is greatly decreased. This lower proportion of does would mean that fewer does would have to be harvested annually to maintain similar population numbers than when sex ratios were much more skewed in favor of does.

Appropriate levels of antlerless harvest are a key way we are managing for desirable deer population levels. However, local differences in habitat condition, hunter density (Figure 15), hemorrhagic disease outbreaks, and deer density change the appropriate level of antlerless harvest necessary to meet desirable levels. While unlimited firearms antlerless permits are a tool that allows landowners and hunters to harvest the appropriate number of deer considering their local situation (deer numbers, hunter density, desired management goal) depending on local conditions and hunter density populations may not be capable of sustaining high levels of harvest. Therefore, careful analysis requires that the availability of antlerless permits meet local conditions. In some areas where liberal harvest regulations (unlimited firearms antlerless permits) have decreased deer numbers, adjustments to the availability of antlerless permits may be necessary to increase or maintain deer numbers at desired levels. Changes to the availability of antlerless permits are an effort to be proactive in management of deer numbers at levels that meet the desires of all stakeholders.

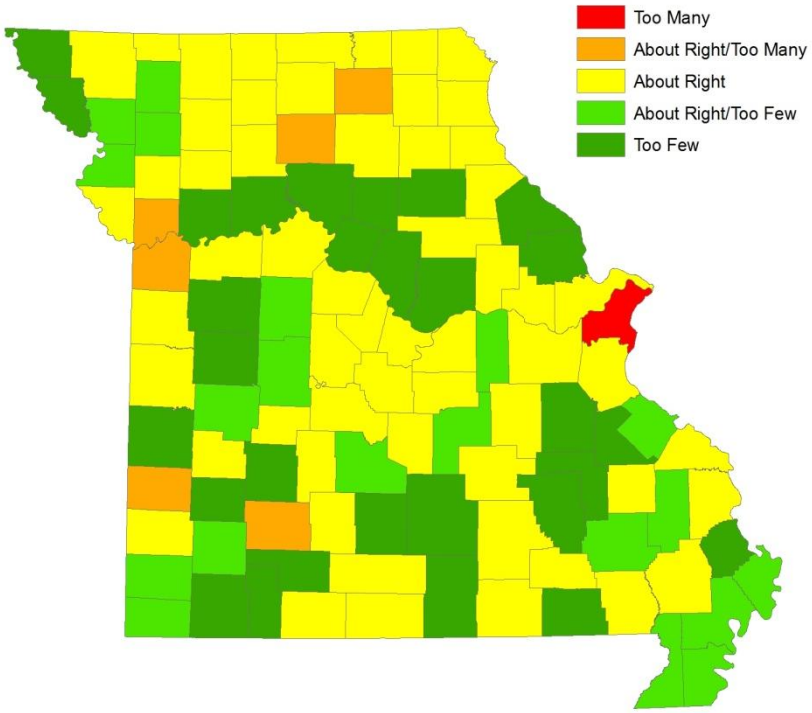


Figure 12. Classifications of county-specific deer population levels in 2012.

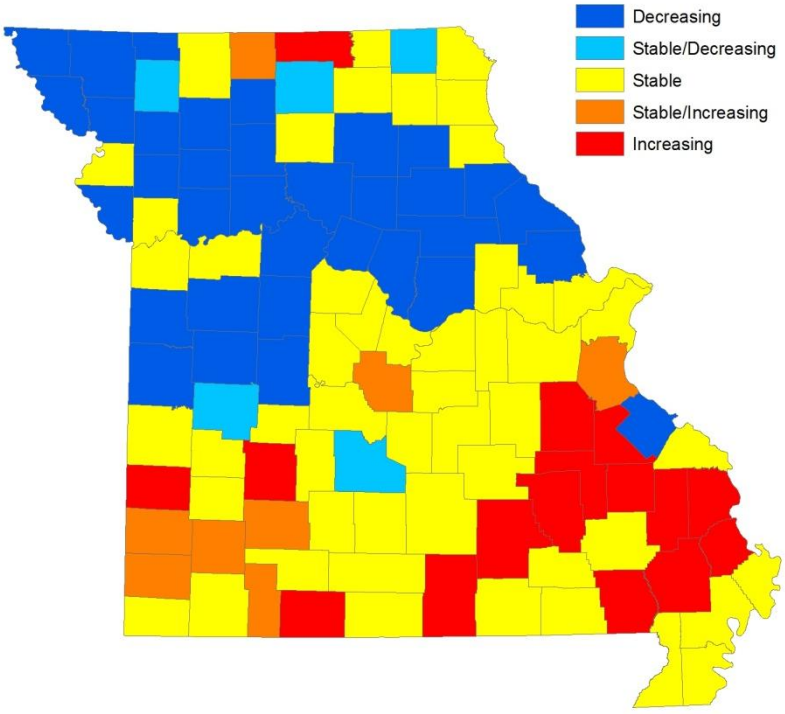


Figure 13. Classifications of county-specific deer population trends in 2012.

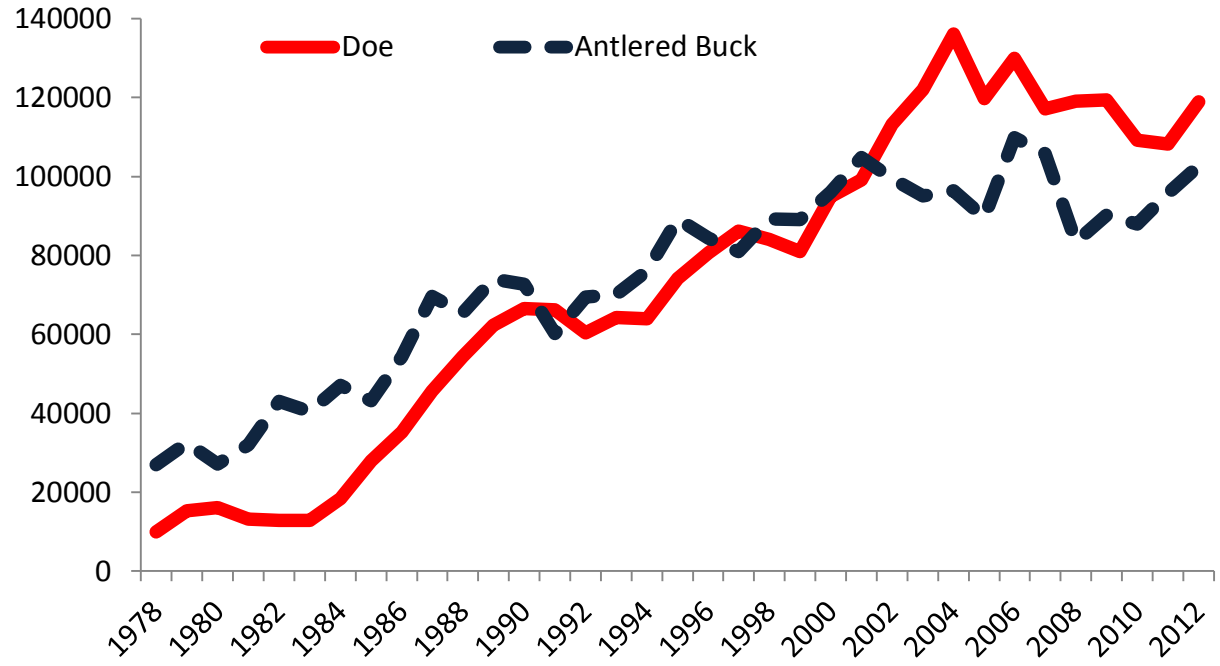


Figure 14. Statewide trend in antlered buck and doe harvest from 1978 to 2010.

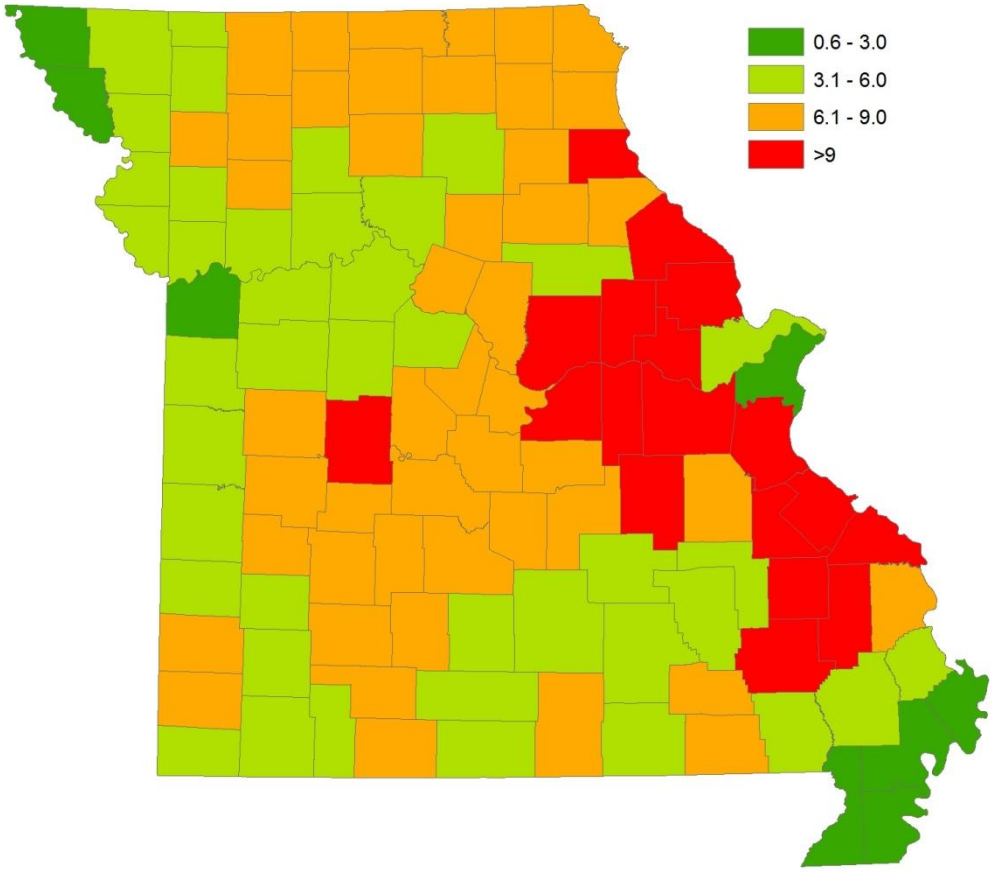


Figure 15. Estimated density (hunters per square mile) of Missouri firearms deer hunters in 2012.

Table 4. Deer permit usage and harvest statistics for the 2012-2013 deer hunting season.

	Archery	Firearms	Archery & Firearms Combined
Resident permits[1]	109,967	350,404	460,371
Non-resident permits[1]	8,412	18,875	27,287
Landowner permits[1]	87,411	181,139	268,550
Total permittees[2]	191,753	495,182	517,618[3]
Age distribution of hunters:			
10 or younger	1,817	23,871	-
11-15	11,351	50,638	-
16-40	84,598	182,590	-
41 or older	93,987	238,083	-
Antlerless permit sales:			
1	28,675	151,084	179,759
2	7,657	28,909	36,566
3	1,654	6,585	8,239
4 or more	1,199	4,240	5,439
Number of deer taken:			
0	154,113	299,741	303,772[4]
1	28,573	150,010	152,147[4]
2	6,549	35,173	42,946[4]
3	1,612	7,250	11,865[4]
4 or more	906	3,008	6,888[4]
Number of antlered deer taken:			
0	175,030	393,711	404,362[4]
1	16,072	100,589	107,085[4]
2	645	851	5,838[4]
3	6	31	333[4]
Percentage taking:			
1 or more deer	19.63	39.47	41.31[4]
1 deer	14.9	30.29	29.39[4]
2 deer	3.42	7.1	8.3[4]
3 or more deer	1.31	2.07	3.62[4]
Percentage taking:			
1 antlered buck	8.38	20.31	20.69[4]
2 antlered bucks	0.34	0.17	1.13[4]
3 or more antlered bucks	0.0	0.0	0.06[4]
Percentage of deer taken by nonresidents	6.5	4.8	5.1
Percentage of deer taken by landowners	25.4	28.4	27.9

[1] Number of any-deer permits issued
[2] Number of individuals possessing a permit, not number of permits issued
[3] Number of individuals that held an archery and/or firearms permit
[4] Number of individuals that harvested the specified number when combining their archery and firearms harvest

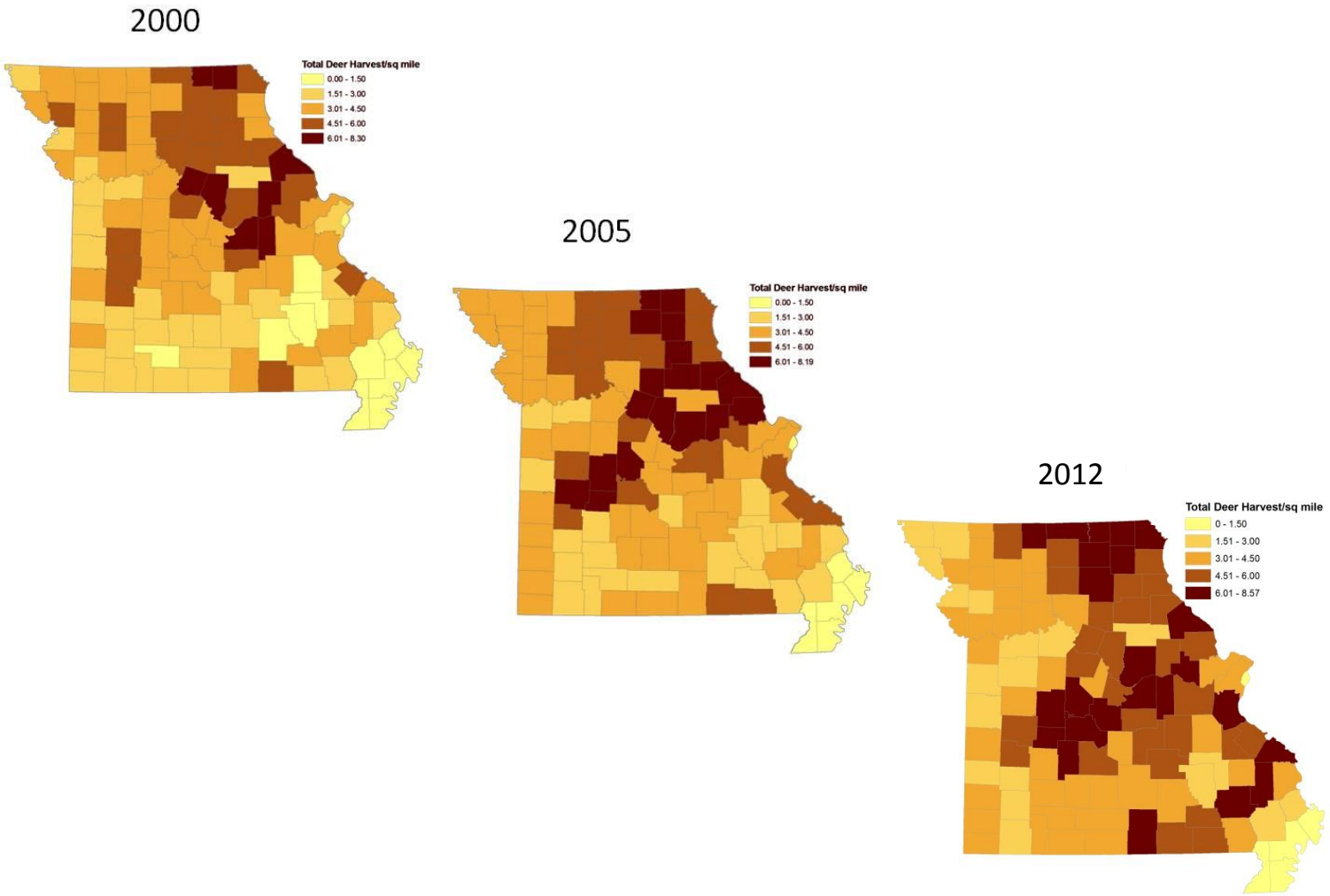


Figure 16. County-specific deer harvest per square mile for 2000, 2005, and 2012 in Missouri.

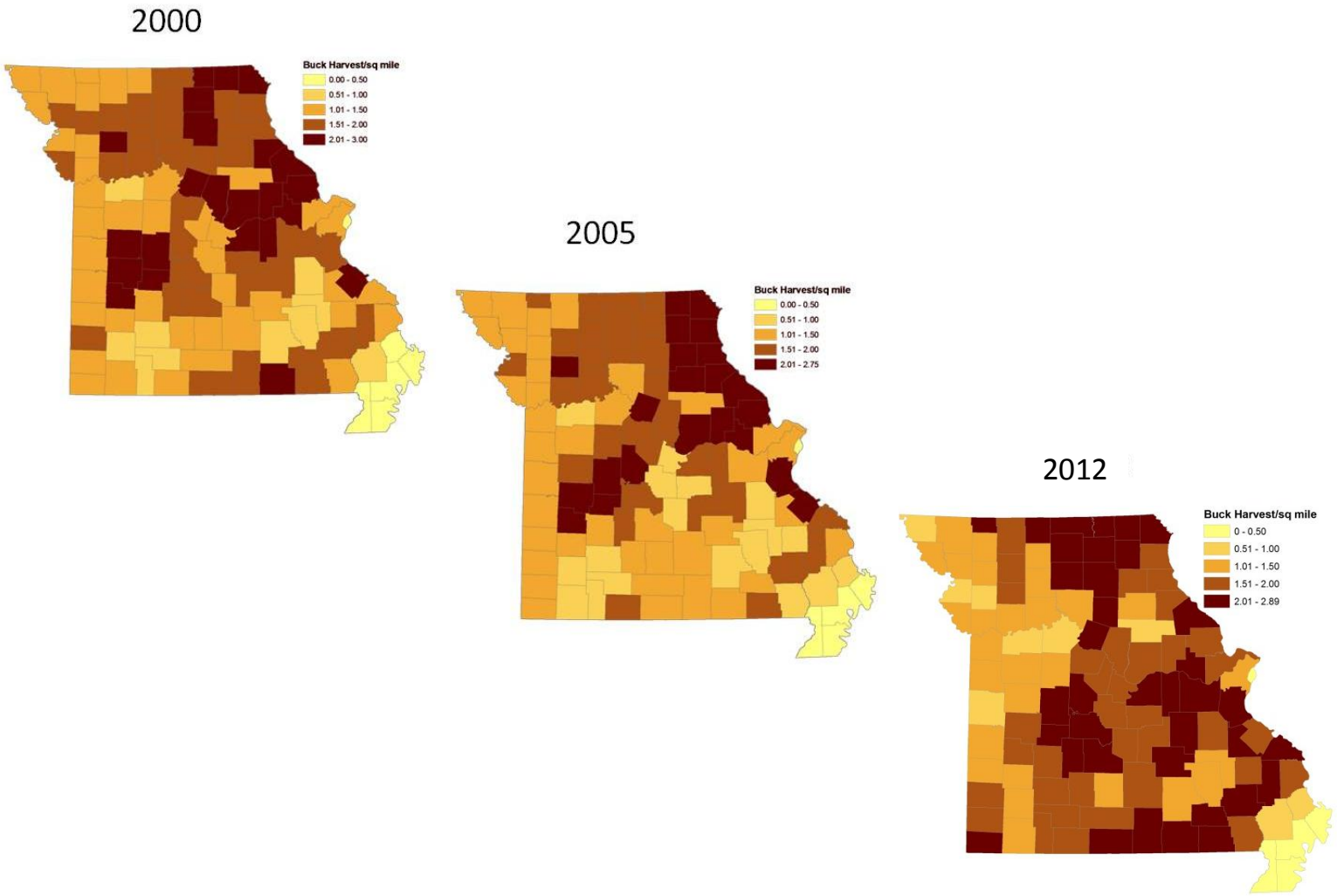


Figure 17. County-specific buck harvest per square mile for 2000, 2005, and 2012 in Missouri.

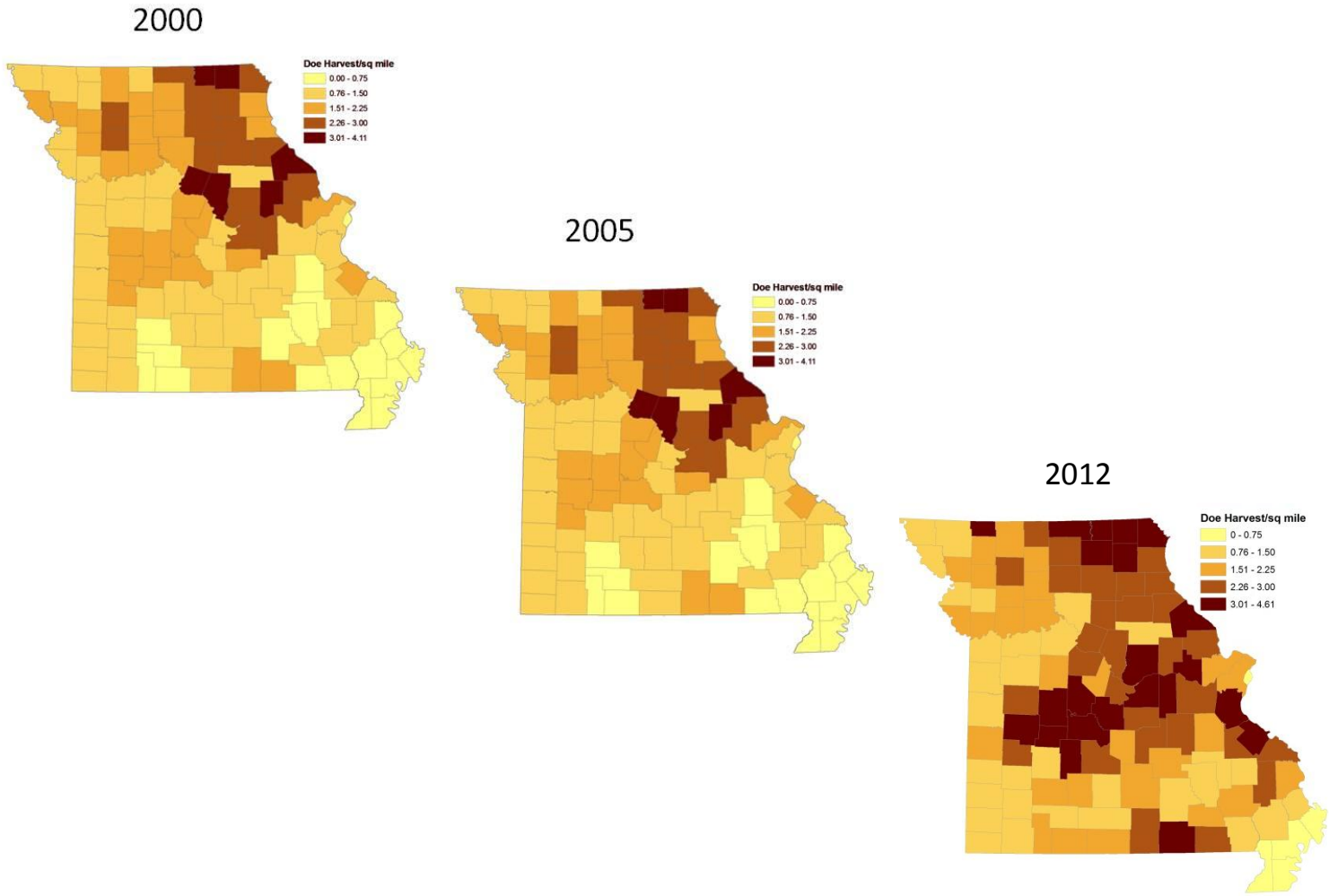


Figure 18. County-specific doe harvest per square mile for 2000, 2005, and 2012 in Missouri.

Changing personal harvest criteria and the implementation of the APR has not only shifted harvest pressure from bucks to does in some areas, but also reduced the harvest pressure on 1.5 year old bucks. This reduced harvest pressure has successfully recruited more bucks in to older age-classes and is reflected in the increasing proportion of the antlered buck harvest made up of bucks at least 2.5 years of age.

An antler point restriction of 4-points on at least one side was first implemented in 2004 for 29 counties in North and Central Missouri (Old North, Old Central; Figure 19). In 2008, the 4-point antler restriction was expanded to all or parts of 66 counties across North and west central Missouri. APR has been successful in reducing yearling buck harvest and increasing recruitment of bucks into older age classes (Figure 20). In counties in which APR was implemented in 2004, the age structure of harvested bucks in 2011 was composed of 20% 1.5 year olds, 54% 2.5 year olds, 21% 3.5 year olds, and 5% 4.5+ year olds.

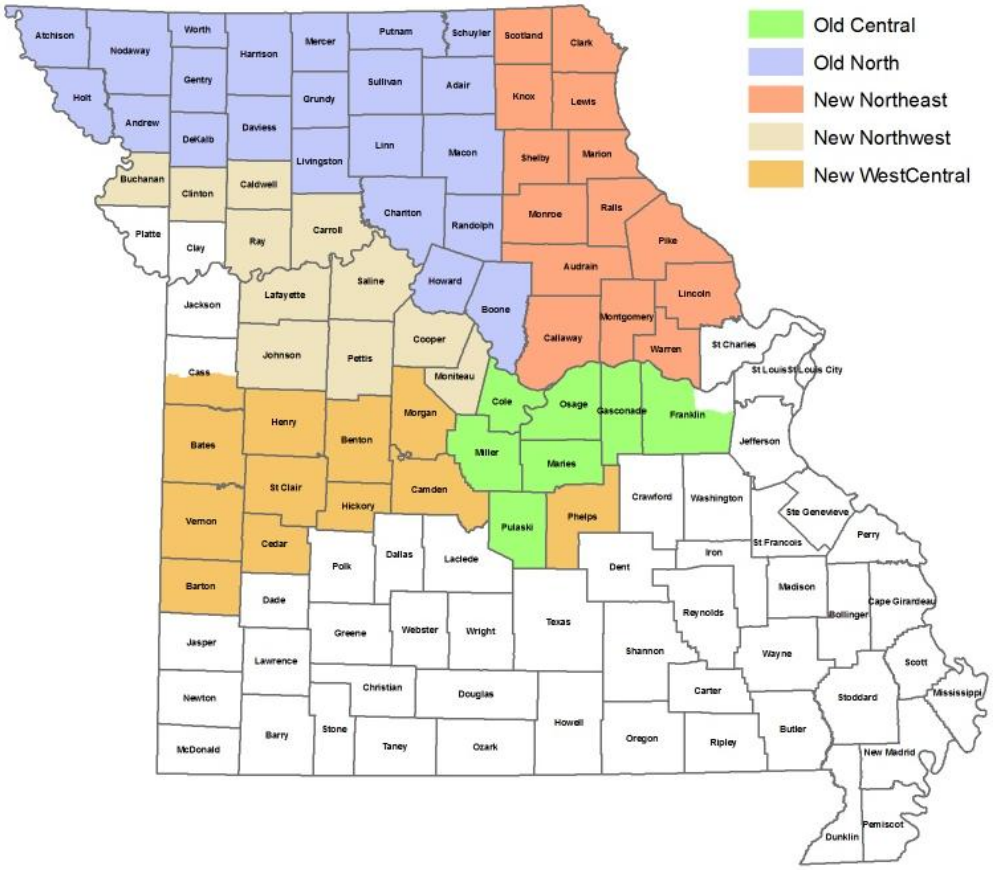


Figure 19. Antler point restrictions were implemented in the Old Central (green) and Old North (blue) counties in 2004 and in the New Northeast (red), New Northwest (tan), and New West Central (orange) in 2008. This map does not illustrate the six Old North counties that were removed from the APR in 2012 due to chronic wasting disease management efforts.

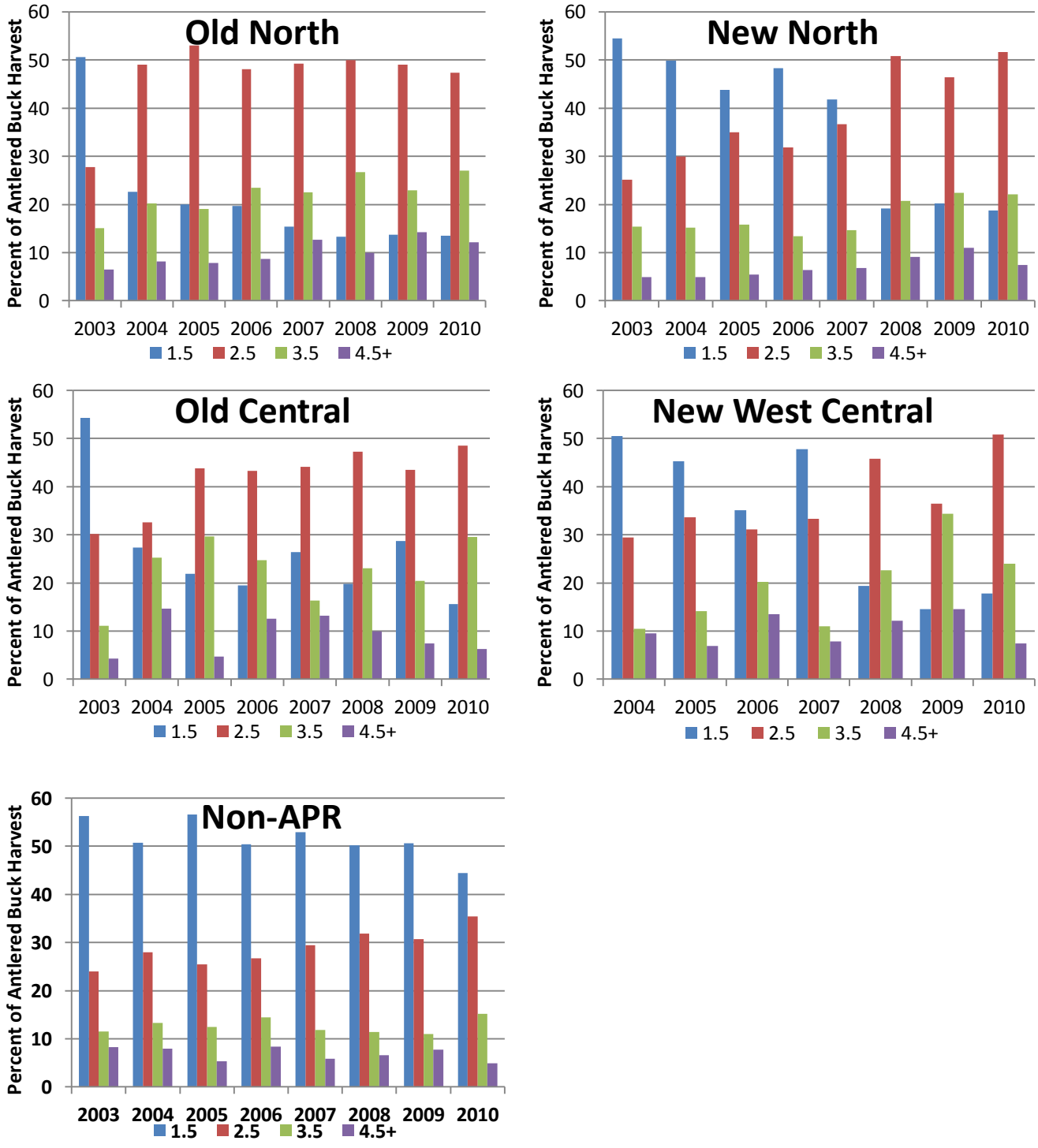


Figure 20. Proportion of antlered buck harvest made up of 1.5, 2.5, 3.5 and 4.5+ bucks for the counties in which an antler point restriction was implemented in 2004 (Old North and Old Central) and 2008 (New North and New West Central) and all other non-antler point restriction counties.

In addition to hunter density and distribution of hunted land, environmental characteristics influence deer abundance and population growth rates. Deer reproductive rates (fawns produced per doe) vary in relation to the availability of nutritious foods. Therefore, deer occupying the most fertile regions historically exhibited greater reproductive rates and have the potential for higher rates of population growth. Missouri can be broken down into 5 major physiographic regions in order; Glaciated Plains, Osage Plains, Ozark Boarder, Ozarks, and Mississippi Lowlands (Figure 21). Varying degrees of soil productivity in addition to historic rainfall patterns and topography has led to some very different land cover types for each of the 5 physiographic regions (Figure 22).

Figure 21. Missouri physiographic regions resulting in very different soil productivity and associated land cover types and land use.

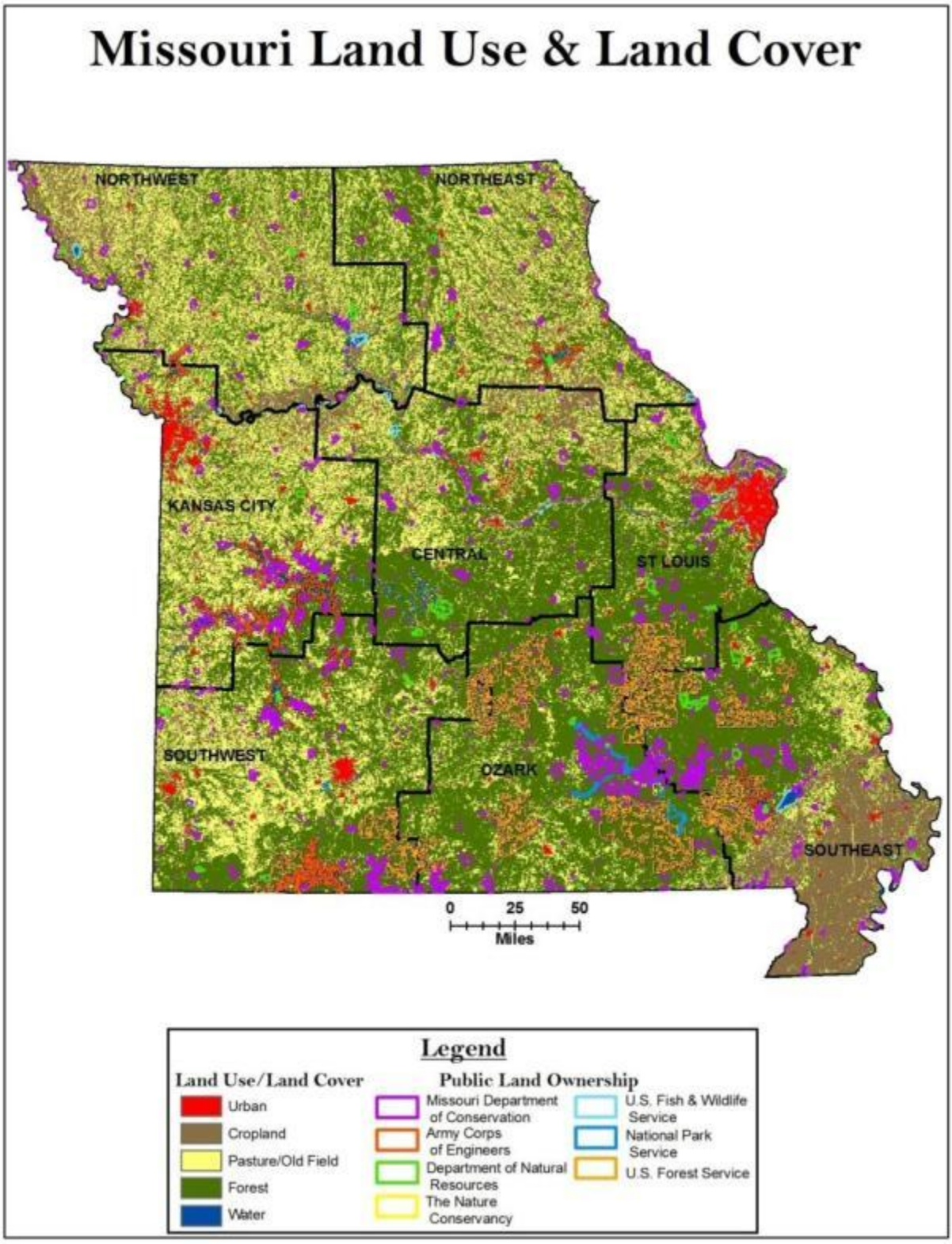
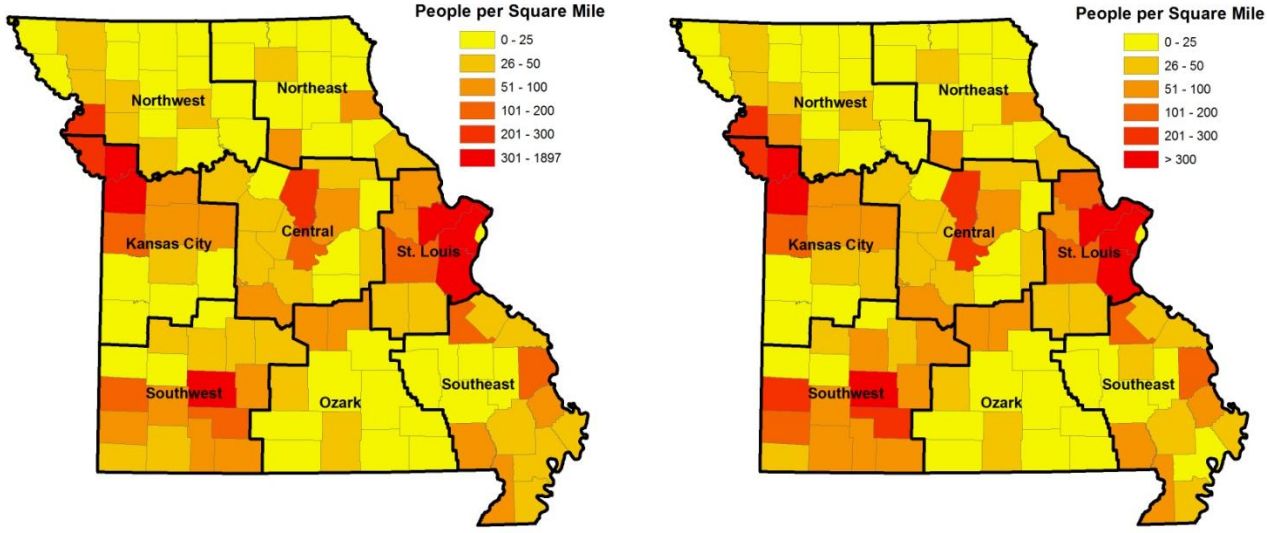


Figure 22. Map of Missouri land use/cover type and distribution of publicly owned lands.

Human Population

There are four major population centers in Missouri centered on Columbia, Kansas City, Springfield and St. Louis. The greatest projected population growth from 2009 to 2025 is predicted to occur around those 4 major population centers as well as along the Interstate-44 corridor between the Springfield and St. Louis and the Interstate-29 corridor between Kansas City and Iowa (Figures 23-25). Areas with the greatest change in human population density are areas that over the next 10-20 years it is expected that human-deer conflicts will increase if deer populations are not managed at acceptable levels.



Figures 23-24. Missouri human population density in 2009 (left) and projected human population density in 2025 (right).

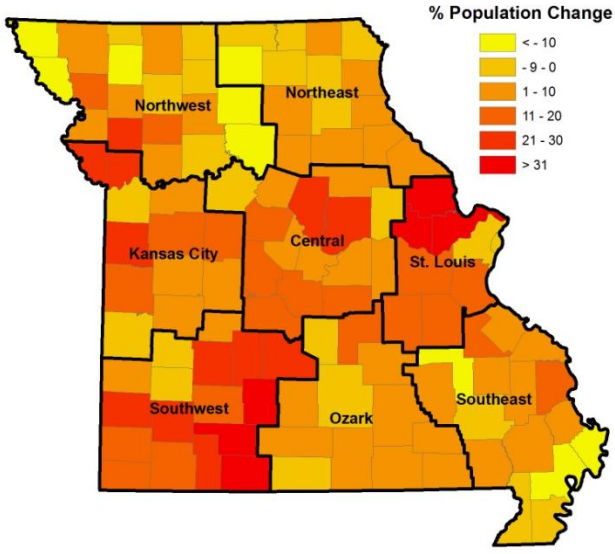


Figure 25. Projected change in human population in Missouri from 2009 to 2025.